2008

Biological Opinion on the Operation of the Missouri River Main Stem System, Operation and Maintenance of the Missouri River Bank Stabilization and Navigation Project, and Operation of the Kansas River Reservoir System

2008 Annual Report

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Omaha District
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List of Acronyms and Abbreviations

Acronym/Abbreviation	Phrase
AM	Adaptive Management
AOP	Annual Operating Plan
ASA(CW)	Assistant Secretary of the Army for Civil Works
BiOp	Biological Opinion on the Operation of the Missouri River Main Stem System, Operation and Maintenance of the Missouri River Bank Stabilization and Navigation Project, and Operation of the Kansas River Reservoir System dated November 30, 2000, and amended December 16, 2003
CADD	Computer-Aided Design and Drafting
cfs	cubic feet per second
°C	degrees Celsius
cm	centimeter
CORE	Cooperating for Recovery
Corps	U.S. Army Corps of Engineers
CRP	construction reference plane
CSRP	Comprehensive Sturgeon Research Project
cy	cubic yards
Dph	day post-hatch
eGIS	Enterprise Geographic Information Systems
EIS	Environmental Impact Statement
ESA	Endangered Species Act
ESH	Emergent Sandbar Habitat
FTC	Fish Technology Center
ft msl	feet mean sea level
FWG	Federal Working Group
FY	Fiscal Year
GIS	Geographic Information System
GPS	Global Positioning System
HAMP	Pallid Sturgeon Habitat Assessment and Monitoring Program
HQUSACE	Corps' Washington D.C. Headquarters
HTC	Hydroscience and Training Center, Colorado State University
IDA Team	Information and Data Advisory Team
kg	kilogram(s)
km	kilometer(s)
LCLSMS	Lewis and Clark Lake Sediment Management Study
LH-RHa	Luteinizing Hormone-Releasing Hormone analogue
LiDAR	Light Detection and Ranging
MAF	million acre-feet
Master Manual	Missouri River Master Water Control Manual
MDC	Missouri Department of Conservation
Mitigation Project	Missouri River Bank Stabilization and Navigation Fish and Wildlife Mitigation Project, Iowa, Nebraska, Kansas and Missouri
mg	milligram(s)
mm	millimeter(s)
MNRR	Missouri National Recreational River
MoRAST	Missouri River Association of States and Tribes
MRBIR	Missouri River Basin Interagency Roundtable
MRERP	Missouri River Ecosystem Restoration Plan
MRERP PDT	MRERP Project Delivery Team
MRNRC	Missouri River Natural Resources Committee
MRRIC	Missouri River Recovery Implementation Committee

MRRP	Missouri River Recovery Program
MTFWP	Montana Fish, Wildlife & Parks
NCER	National Center for Ecosystem Restoration
NFH	National Fish Hatchery
NGPC	Nebraska Game and Parks Commission
NPS	National Park Service
NPWRC	Northern Prairie Wildlife Research Center
NRCS	Natural Resources Conservation Service
NTU	Nephelometric turbidity units
NWD	Corps' Northwestern Division
NWHC	National Wildlife Health Center
PDT	Product Delivery Team
PEIS	Programmatic Environmental Impact Statement
PgMP	Program Management Plan
PMs	Project Managers
PIT	Passive Integrated Transponder
plans and specs	plans and specifications
PMP	Project Management Plan
PNNL	Pacific Northwest National Laboratory
PPAP	(Pallid Sturgeon) Propagation and Population Augmentation Project
PWR	Project Work Request
RM(s)	River Mile(s)
RPA	Reasonable and Prudent Alternative
RPM	Reasonable and Prudent Measure
SDGFP	South Dakota Game, Fish and Parks
SDM	Structured Decision Making
SDSU	South Dakota State University
SFH	State Fish Hatchery
SPDT	Senior Product Delivery Team
Spp	species within the genus (standard scientific abbreviation)
SRFM	Spring Rise Flow Modification
SWH	Shallow Water Habitat
System	Missouri River Main Stem System
UNL	University of Nebraska, Lincoln
URL	Uniform Resource Locator
USD	University of South Dakota
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
U.S. Institute	U.S. Institute for Conflict Resolution
VPI	Virginia Polytechnic Institute
WBS	Work Breakdown Structure
Work Plan	Annual Work Plan
WRDA	Water Resources Development Act
YOY	young-of-year

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Introduction

The U.S. Army Corps of Engineers (Corps) prepared this annual report for interested parties in accordance with reporting recommendations of the Biological Opinion on the Operation of the Missouri River Main Stem System (System), Operation and Maintenance of the Missouri River Bank Stabilization and Navigation Project and Operation of the Kansas River Reservoir System, prepared by the U.S. Fish and Wildlife Service (USFWS) dated November 30, 2000, and the Amendment thereto, dated December 16, 2003 (BiOp). This annual report also documents the Corps' activities implemented under the Missouri River Bank Stabilization and Navigation Fish and Wildlife Mitigation Project, Iowa, Nebraska, Kansas and Missouri (Mitigation Project). Congress first authorized construction of the Mitigation Project in Section 601(a) of the Water Resources Development Act (WRDA) of 1986 (Public Law 99-662). Section 334(a) of WRDA 1999 (Public Law 106-53) modified the Mitigation Project by increasing the amount of acreage to be acquired and/or mitigated. The total amount of land authorized for mitigation is currently 166,750 acres.

This report documents Corps activities and progress in implementation of the elements of the Reasonable and Prudent Alternative (RPA), Reasonable and Prudent Measures (RPM), and Conservation Recommendations outlined in the BiOp for the federally listed threatened and endangered species on the Missouri River and activities implemented under the Mitigation Project for calendar year 2008. These activities were carried out as part of the larger Missouri River Recovery Program (MRRP). Only those items that are required for calendar year 2008 or have been accelerated in the BiOp schedule are included in this annual report. Activities described in this annual report are summarized below. A more detailed description of these activities is provided in the main document.

Section I, Missouri River Ecosystem Restoration Plan (MRERP) and Environmental Impact Statement (EIS). This section includes an introduction to what the MRERP/EIS is, its objectives, and work accomplished during 2008.

Section II, Habitat Creation. This section describes efforts involved with emergent sandbar habitat (ESH) creation, shallow water habitat (SWH) creation, floodplain development, and real estate acquisition along the Missouri River during 2008.

Section III, Flow Modifications. This section describes implementation of the Gavins Point Dam Spring Pulse, Fort Peck Flow Modification, Unbalanced Intrasystem Regulation, and work accomplished on sediment studies during 2008.

Section IV, Science. This section describes the science-related activities on the Missouri River ecosystem and the native species, with the focus on the federally listed pallid sturgeon (*Scaphirhynchus albus*), least tern – interior population (*Sterna antillarum*), and piping plover (*Charadrius melodus*) and on the bald eagle (*Haliaeetus leucocephalus*). A description of Adaptive Management is provided first followed by a summary of science-related activities for the pallid sturgeon, least tern, piping plover, and bald eagle.

Section V, Public Involvement and Communications. This section provides information on efforts associated with the Missouri River Recovery Implementation Committee (MRRIC), the Information and Data Advisory Team (IDA Team), the Enterprise Geographic Information Systems (eGIS), and the Communications Plan.

I. Missouri River Ecosystem Restoration Plan and Environmental Impact Statement (WRDA 2007 Section 5018 Study)

The MRERP and MRRP are complementary efforts led by the Corps in partnership with the USFWS to protect, recover, and restore the Missouri River ecosystem and its native species. The MRERP will provide a long-term, focused analysis of basin-wide restoration, mitigation, and recovery needs of the Missouri River for the next 30 years. It will provide a comprehensive perspective to accomplish restoration objectives and reduce conflict over scarce resources while balancing the river's social, economic, and cultural values. The final product of the planning process will be a document that outlines a future vision for the river and the tools needed for implementation. As part of the process, the Corps will produce an EIS to ensure that the environmental effects of restoration activities recommended in the plan are analyzed and considered before implementation begins. The plan will be prepared in consultation with other federal and stage agencies, basin Tribes, and many other basin stakeholders, including the MRRIC.

WRDA 2007 provided additional authority for the planning effort for MRERP. Subsection (a) of Section 5018 of WRDA 2007 directs the Secretary of the Army, in consultation with the MRRIC, to conduct a study of the Missouri River and its tributaries to determine actions required to:

1. Mitigate losses of aquatic and terrestrial habitat;
2. Recover federally listed species under the Endangered Species Act; and,
3. Restore the ecosystem to prevent further declines among other native species.

During 2008, the Missouri River Ecosystem Restoration Plan Project Delivery Team (MRERP PDT) conducted a wide array of activities. Primary focus centered on finalizing implementation guidance, continuation of project initiation, establishing cooperating agencies, conducting consultation with basin Tribes, and preparing for the MRRIC. The MRERP PDT has remained on schedule with the products and deliverables, as outlined in the MRERP Project Management Plan (PMP) and Work Breakdown Structure (WBS).

Implementation guidance was drafted by the two MRERP Project Managers (PMs), routed through the Corps' Northwestern Division (NWD) and Washington, DC Headquarters (HQUSACE), and formally endorsed by the Assistant Secretary of the Army for Civil Works [ASA(CW)] on September 29, 2008.

In March 2008, the MRERP PMP was finalized. It was signed by the two MRERP PMs, the Missouri River Recovery Program (MRRP) Program Manager, the MRRP Executive Steering Committee, the MRRP Senior Program Delivery Team (SPDT), and the Omaha and Kansas City Districts' Planning Branch leadership.

Initial communications tools for the MRERP were then developed. Preliminary fact sheets and newsletters were developed and distributed at each of the project initiation presentations, meetings, and conferences.

During project initiation, the MRERP PMs presented the project at several meetings and conferences to share information with states, Tribes, and Federal agencies to determine the appropriate avenue for establishing cooperating agencies. Among these were presentations at the Missouri River Association of States and Tribes (MoRAST) meetings on February 25 and May 19, 2008 and the Missouri River Natural Resources Committee (MRNRC) Conference on February 26, 2008.

Communications with some of the basin's Tribes were conducted during the initial steps of project initiation as well. Many of these meetings simultaneously included discussions of the MRRIC. During the months of March through June, meetings were held with the Assiniboine and Sioux Tribes of Fort Peck, Blackfeet Nation, Cheyenne River Sioux Tribe, Chippewa-Cree Tribe, Crow Creek Sioux Tribe, Crow Nation, Flandreau Santee Sioux, Iowa Tribe of Kansas and Nebraska, Kickapoo Tribe, Lower Brule Sioux Tribe, Northern Arapaho Tribe and Shoshone, Northern Cheyenne, Oglala Sioux Tribe, Omaha Tribe, Rosebud Sioux Tribe, and Winnebago Tribe for purposes of Tribal participation in the MRERP. The MRERP was also presented at the 2008 Native American Fish and Wildlife Society National Conference in

mid-May, the National Tribal Conference on Environmental Management in late June, and the Native American Fish and Wildlife Society 20th Annual Great Plains Regional Conference in mid-August.

Following individual, regional, and national Tribal engagement, the MRERP PDT then engaged in a series of basin-wide, pre-cooperating agency meetings with each state in the basin. The MRERP PDT traveled to each state to introduce the MRERP to the states as well as some Federal agencies. These meetings also provided states and others with the first real opportunity to discuss their future roles and level of involvement in the MRERP. As a result, many of the states requested more information regarding their staff and time commitments relative to becoming a cooperating agency on the MRERP.

The MRERP PMs also hosted a meeting in late May in Denver, Colorado with the Federal Working Group (FWG) and the Missouri River Basin Interagency Roundtable (MRBIR). Multiple MRERP presentations were made and brainstorming sessions concerning the role of FWG in MRERP and the upcoming relationship with MRERP and MRRIC took place. The MRERP PMs provided a presentation for the MRBIR to bring awareness of the MRERP to Federal agency executives and staff and to garner interest and assignment of staff to the MRERP cooperating agency effort.

On August 4, 2008, the Cooperating Agency Desk Guide was completed and was handed out at the cooperating agency invitation meetings. In addition to the Desk Guide, a draft Cooperating Agencies Level of Effort and Engagement document was developed and handed out, which together with the Desk Guide provided each potential cooperating agency with a very detailed account of roles, responsibilities, and resources they would need for participation in the MRERP process.

A final series of cooperating agency recruitment meetings began in September and October and concluded with a MoRAST and general MRERP meeting in December 2008. During the September and October meetings, the MRERP PDT traveled to each state again to provide final detail regarding cooperating agency commitments. These meetings served again as the vehicle for informal invitation to participate in the MRERP as a cooperating agency.

All of the aforementioned meetings as well as public release (via www.mrerp.org) of a suite of communication tools played an important role in establishment of the cooperating agency team. The initial project website, www.mrerp.org , was launched and is active. Hosted on the website (and handed out at each meeting, conference, etc.) are multiple newsletters and fact sheets. The website is also a portion of the overall MRRP website.

Formal letters requesting an acceptance of cooperating agency status from each of the basin's Tribes, states, and associated Federal agencies were sent out October 3, 2008. As of November 24, 2008, eight Federal agencies (Bureau of Reclamation, Environmental Protection Agency, Federal Emergency Management Agency, National Forest Service, National Oceanic and Atmospheric Administration, National Park Service (NPS), U.S. Geological Survey [USGS], and Western Area Power Administration), four states (Missouri, Montana, South Dakota, and Wyoming), and two Tribes (Assiniboine and Sioux Fort Peck Tribes and Yankton Sioux Tribe) have sent back acceptance letters designating formal cooperating agency points of contact. Many more have verbally indicated that their acceptance letter will be arriving shortly.

To engage, track, and maintain records of Tribal, state, Federal, stakeholder, public and pre-cooperating agency communications, a MRERP Long-Term Communication Plan is being developed. The bulk of this document was completed prior to the end of 2008, but this document will remain as a living document to be used to follow and manage communication with people throughout the basin. This will be accomplished through coordination with the MRERP contact and communication database, already in initial development and use.

During September 29-October 2, 2008, the MRERP PMs also attended and presented at the inaugural MRRIC meeting in St. Louis, Missouri. The MRERP PMs familiarized the MRRIC with the MRERP. The MRRIC members submitted questions and concerns regarding the MRERP process and plan, which were responded to at the December 16-18, 2008 MRRIC meeting.

In mid–November, the MRERP PMs traveled to Portland, Oregon to meet with NWD staff and establish appropriate milestones for MRERP, to determine the most appropriate specific Corps guidance to follow, and to prepare for upcoming HQUSACE and ASA(CW) briefings on MRERP.

The Notice of Intent to prepare an environmental impact assessment is being developed and was scheduled to be published in the Federal Register in December 2008. However, due to MRRIC concerns, this was delayed until January 2009.

II. Habitat Creation

II.A. Emergent Sandbar Habitat Creation Activities

II.A.1. Vegetation Removal Projects

The multi-agency Vegetation Management Product Delivery Team (PDT) made the decision to wait for the results of the vegetation modification study before performing any additional vegetation management actions. Therefore, no vegetation removal projects were conducted during 2008. The vegetation modification study will be complete the fall of 2009.

II.A.2. Dredge and Mechanical Construction Projects

Early ice conditions in Lewis and Clark Lake and in the river reach below Gavins Point Dam in the fall of 2007, combined with late ice conditions on the System in the spring of 2008, resulted in delays to several contractors' schedules. Summaries of the construction of emergent sandbar habitat (ESH) are provided in the following paragraphs. More detailed information is contained in the after-action report prepared for three of the sandbars, constructed at River Miles (RM) 791, 777.7, and 775.

River Mile 863: Sandbar complex size: 42 acres. Bid opening was held for the sandbar at RM 863 in September 2008; however, due to unresolved issues with the Yankton Sioux Tribe, an award was not made. Meetings have been held with Tribal members and will be continued to be held until a resolution is reached. The project can be re-advertised if issues are resolved for construction in the spring and/or fall of 2009.

River Mile 827: Sandbar complex size: 150 acres. Work resumed on a sandbar at RM 827 after the last bird vacated the sandbar complex in September 2008. No work was accomplished in the spring of 2008 because additional time was required to pursue the reissuance of a regulatory permit that was inadvertently allowed to lapse. The contractor completed construction of the complex on December 4, 2008. Photograph 1 was taken at this sandbar complex at 80 percent completion.

River Mile 827 Photo by Harry Weddington

Photograph 1. Sandbar complex at RM 827.

River Mile 791: Sandbar complex size: 40 acres. Construction of a sandbar at RM 791, shown in Photograph 2, was completed in the spring of 2008 using no dredging. Instead the construction method consisted of gathering material from around the sandbar to be created using backhoes and distributing it according to specifications using earth-moving equipment. Borrowing material from the area adjacent to the sandbar resulted in a deeper circle around the sandbar, drawing water into both long sides of the sandbar and causing the cut-bank erosion to occur almost immediately after construction was completed. The cut bank areas limit plover foraging. Future designs have incorporated a 75-foot, no-borrow zone immediately adjacent to the sandbar to prevent this erosion pattern from happening at future sites. The Gavins Point hired labor crew worked during the fall and possibly will continue in the spring to reshape cut-bank areas to appropriate slopes to correct this situation.

River Mile 791 Photo by Harry Weddington

Photograph 2. Sandbar at RM 791.

River Mile 777.7: Sandbar complex size: 74 acres. Sandbar construction at RM 777.7, shown in Photograph 3, included creation of a 15-acre backwater in the adjacent state of South Dakota Frost Wildlife Management Area. Dredged material from the creation of the backwater was pumped to partially build the sandbar. The remaining material needed to build the sandbar was dredged from the river bed surrounding the sandbar. Earth moving equipment was used to spread the dredged material to the specified elevation configuration. Construction of this sandbar complex was completed in the spring of 2008.

River Mile 777.7 Photo by Harry Weddington

Photograph 3. Sandbar complex at RM 777.7.

River Mile 775: Sandbar complex size: 44 acres. A combination of dredging and earth-moving equipment was used to construct this sandbar. Construction began in the spring of 2008. The contractor was able to complete 60 percent of the sandbar prior to the birds' arrival in May. The contractor halted construction during the nesting season and resumed in early September after the last bird left the area. Construction was complete in October 2008. Photograph 4 was taken during the construction of the project.

River Mile 775 Photo by Harry Weddington

Photograph 4. Sandbar complex at RM 775.

River Mile 774: Sandbar complex size: 49 acres. The contractor had planned for a spring of 2008 start and completion date on this complex but did not begin construction until September 2008. The construction methodology consisted of dredging material and spreading it to elevation requirements with earth-moving equipment. Construction was completed December 1, 2008.

River Mile 795: Sandbar complex size: 76 acres. Contractor began construction in October 2008 and completed November 15, 2008. Contractor utilized earth-moving equipment to construct this sandbar. No dredging was used at this site, with the borrow area at least 75 feet from the perimeter of the sandbar.

II.A.3. Coordination for Future Projects

The ESH PDTs met several times in 2008. The overarching ESH PDT, including representatives from the USFWS, NPS, States of Nebraska and North Dakota, Natural Resource Conservation Service (NRCS), U.S. Department of Agriculture (USDA), and the Corps, met in Yankton, South Dakota on April 1 and 2, 2008. The state of South Dakota was invited but was unable to attend. Agenda topics included Structured Decision Making and Modeling; Conservation Action Planning, Spring Pulse and Water Management Updates; Review and Discussion of FY 07 Least Tern and Piping Plover numbers; ESH Accounting System; Real Estate Protocol Update; FY 07, 08, and 09 ESH Construction Projects; Biological and Physical Monitoring and Annual Work Plans; Vegetation Management Plan Update; MNRR Mussel Survey Results; Turtle Work in the Missouri National Recreation River; Sediment Management Update; and Predator Management Plan Update.

The North Dakota ESH PDT met for a trip on the river August 5 and 6, 2008. Members of the USFWS, the North Dakota State Water Commission, and the North Dakota Game and Fish Department joined the Corps on a trip to sites below Garrison Dam and in the Bismarck vicinity. Bird usage of existing sandbars and potential future ESH construction projects were discussed. Another North Dakota ESH PDT meeting was held on November 4, 2008 at the USFWS Office in Bismarck. All agencies listed above were represented at this meeting. All agreed that, for the most part, the birds were maintaining steady populations on this reach of the river; however, with the anticipated continued rise in reservoir levels, there could be a habitat creation project in the fall of 2009 (fiscal year 2010) to assure that the birds have adequate habitat available.

The Fort Randall River, Lewis and Clark Lake, and Gavins Point River Segments ESH PDT met twice in 2008. The first meeting was held on June 11 and 12, 2008 in Yankton. Participants included staff from the USFWS, NPS, and Corps. A combination of river site visits and viewing Google Earth imagery was used to assist with the discussion of future ESH construction opportunities. Several projects were identified for fiscal year 2009 construction. This ESH PDT also met on November 17, 2008 for the initial design team meeting for ESH construction of sandbars at RM 781, RM 781.4, and RM 842. Several other sites were identified as well for future design consideration.

II.A.4. Programmatic Environmental Impact Statement

A staff-level Cooperating Agency meeting was held on March 6, 2008 to discuss the status of the Programmatic Environmental Impact Statement (PEIS) and the alternatives addressed in it. Subsequently, the PEIS work product delivered to the Corps in 2008 was the preliminary draft of the entire contracted portion of the PEIS for limited internal review. The 900-page document was delivered on September 5, 2008 and will be revised for a broader review. Internal work products for the PEIS, such as the Real Estate Appendix, Monitoring Appendix, and Adaptive Management Appendix, are currently being prepared to be at a comparable "preliminary draft" level of completion.

II.A.5. Missouri River Emergent Sandbar Habitat Evaluation

In 2008, the Corps continued to monitor and evaluate constructed and manipulated sandbar habitat complexes to determine if the physical and biological requirements of the birds are being met. The Habitat Evaluation PDT met prior to the field season and discussed changes that were incorporated into the 2008 Annual Work Plan. Changes included discontinuing fish and aquatic habitat sampling and the exclusion of sampling in vegetation modification sampling segments. The goals and objectives for the 2008 Habitat Evaluation were the same as in 2007 and are reiterated below.

Goal:

> *To determine if managed emergent sandbar habitat is providing suitable habitat features for nesting and foraging least terns and piping plovers, while not being deleterious to other ecosystem functions or social values.*

Objectives:

1) Evaluate the effects of ESH projects on nesting and foraging habitat and productivity of least terns and piping plovers.

2) Identify potential important collateral effects of ESH projects on other ecosystem attributes or social values.

3) Examine linkages between habitat features and productivity in relation ESH projects to provide guidance for future project planning and design.

Extent of Sampling
Sampling locations were selected based on the best available current information on locations of previously constructed ESH projects and locations where ESH projects are likely to be implemented after the 2008 nesting season. In accordance with the ESH Monitoring Plan (Sherfy et al. 2007), the sampling units for ESH were 0.4-River Mile segments on four riverine segments. Sampling segments were selected by scientists at USGS-Northern Prairie Wildlife Research Center (NPWRC), based on a suite of variables identified in the ESH Monitoring Plan. Four segments were sampled on the river below Fort Randall Dam, six on Lewis and Clark Lake, and 34 segments on the river below Gavins Point Dam. Thirty points were sampled within each sampling segment, and invertebrate sampling occurred at a minimum of five points within each sampling segment. A total of 1445 points were sampled, and invertebrate data were collected at 346 of these points.

Analysis
Analysis of the 2006 through 2008 data will be conducted by USGS-NPWRC and completed by late February 2009. A final report will be available by late March 2009 summarizing the findings of the habitat evaluation. The analysis will attempt to answer the following questions: 1) How does quality of nesting habitat compare among sampling segments containing created, modified, and natural sandbars? 2) How does foraging habitat compare among segments containing created, modified, and natural sandbars? 3) What are the differences in responses to modification projects over time? 4) What is the quality of habitat on the sampled Missouri River segments?

II.B. Shallow Water Habitat Creation Activities

II.B.1. Omaha District Design Activities

Blackbird Bend: Estimated shallow water habitat (SWH): 100-300 acres. This project is located on the left bank of the Missouri River near RM 698. The project includes multiple features with the design goal to provide surface water flow to the downstream Tieville - Decatur Bend complex. The Iowa Department of Natural Resources proposed a revised design concept that is in the evaluation process. Field surveys were conducted in August 2008 to support the design. Design efforts are ongoing.

Boyer Bend and Lower Calhoun Bend: Estimated SWH: 52 acres. This project is on the left bank from RM 637.5 to RM 634.1. The Boyer Bend portion of the project includes a linear backwater parallel to the river with numerous slope variation areas. The upstream end of the backwater area ends near the river but does not include a direct connection. The Lower Calhoun Bend portion of the project consists of a right bank chute about 2,800 feet in length, with the entrance near RM 637.5. The chute includes a main chute with a bottom side of 80 feet and two higher-level chutes that braid through the main chute. Several areas with gradual side slope are also included. Excavation quantities are over 530,000 cubic yards (cy) for the Boyer Bend backwater and over 120,000 cy for the Lower Calhoun Bend chute. Construction award for this project occurred in December 2008.

Bullard Bend: Estimated SWH: 25 acres. This project includes a backwater connection near RM 663.1. The project will consist of excavating a nearly 5,000-foot-long backwater, with a minimum bottom width of 50 feet and variable side slopes between 5 horizontal feet to 1 vertical foot and 10 horizontal feet to 1 vertical foot. The backwater will also include two over-wintering holes for fish. In addition to the backwater, the Corps also assisted the land owner and the NRCS in designing two wetland depressions that are not connected to the backwater. Construction of these wetlands will be the responsibility of the land owner and the NRCS. A total of approximately 310,000 cy of material will be removed from the backwater. This project was awarded for construction in September 2008.

Fawn Island: Estimated SWH: 9 acres constructed with a maximum future potential of 13 acres. Fawn Island is a left-bank chute near RM 673.6. The project will consist of the construction of a nearly 3,000-foot-long, 150-foot-wide chute on low ground parallel to the Missouri River. Approximately 200,000 cy of material will be removed. A small design modification is underway to include chute enhancement features intended to increase diversity. Anticipated construction award is the spring of 2009.

Middle Decatur Bend: Estimated SWH: 14 acres constructed with a maximum future potential of 20 acres. This project is a right-bank chute from RM 688.2 to RM 687.5. The chute length is approximately 4,400 feet with a bottom width of 75 feet. The upper 3,000 feet of the chute includes a 10-horizontal-feet-to-1-vertical-foot channel with constructed side slope and rock / woody structures to add diversity. Approximately 220,000 cy of material will be removed. This project was awarded for construction in September 2008.

Plattsmouth Bend Backwater Phase II: Estimated SWH: 25 acres. Located at RM 592, this backwater connects to the previously constructed habitat features off the Plattsmouth chute and backwater within Shilling Wildlife Management Area. The backwater area contains numerous slope variations with variable width. Approximately 440,000 cy of material will be removed. This project was awarded for construction in September 2008.

Tobacco Bend: Estimated SWH: 70 acres. Field surveys and design analysis were performed on the chute at Tobacco Island. The right-bank chute was constructed in the early 2000's as a 15,400-foot-long channel with an entrance near RM 589.2 and the exit near RM 586.2. The chute was originally constructed with a pilot channel that employed a bottom width of 20 feet. The chute has not expanded and has experienced shoaling issues. During project construction, several issues developed that impacted project function. An evaluation was conducted to compare the current chute invert to the original design. Plans were developed to restore the invert elevation.

Tyson Bend: Estimated SHW: 70 acres constructed, including the existing backwater, with a maximum future potential of 151 acres. The Tyson Bend project provides for the construction of SWH within the left-bank floodplain of the Missouri River between RM 655.5 and RM 653.1. This project consists of expanding the existing backwater previously constructed in 2004, constructing a new chute, and relocating a boat ramp. The total chute length is 13,500 feet. The chute exit through the existing backwater includes a rock separation dike and an outlet dike revision to reduce backwater sediment deposition. A project construction package was prepared utilizing a base contract with two options. The base contract is for the expanded backwater excavation and rock placement in the lower portion of the project area and was awarded in July 2008. The first option, to construct the lower 9,234 feet of the chute, was awarded in November 2008. Real estate issues prevent the award of the upper portion of the chute at this time. The backwater expansion will result in approximately 28 acres additional to the original 25 acre backwater that was created in 2004. Due to the side slope configuration, the maximum future SWH backwater area for the new site is estimated as 68 acres. The first chute option will create an additional 12 acres of SWH with a maximum potential of 29 acres. The second chute option will create another 5 acres of SWH with a maximum potential of 29 acres.

River Structure Control Modifications: Estimated SWH: 23-40 acres north of Omaha and 32-58 acres south of Omaha. This work is a continuation of previous activities and consists of projects intended to enhance channel widening and increase in-channel SWH. Project features include dike notching, dike extension, and reverse sills. Two contract actions were included for areas north and south of Omaha. The north section includes work at Lower Little Sioux, Desoto, Middle Blencoe, and Boyer Bends, with a total of 47 new or modified structures. The south section includes work at Hamburg, Pin Hook, Nebraska, Tobacco, Rock Bluff, and Copeland Bends, with a total of 58 structures modified. All options were awarded during the fall of 2008.

II.B.2. Omaha District Construction Activities

Lower Decatur Bend: Estimated SWH: 14 acres constructed with a future maximum of 45 acres. This project lies along the south bank of the Missouri River, between RM 687.5 and RM 684.5, approximately 2 miles southeast of Decatur, Nebraska. The primary feature is the lowering of 8,200 feet of revetment by about 8 vertical feet. The goal is to allow the river to erode the land behind the lowered revetment, eventually cutting back up to 175 feet. A 2,400-foot-long chute was built just downstream of the lowered revetment, with a bottom width of 150 feet. Three stone weirs were placed in the chute, to provide diversity.

River Mile 684.5

Photograph 5. Lower Decatur Bend revetment lowering.

River Control Structure Modifications: Estimated SWH: 16 acres will be constructed with a future maximum of 32 acres. Construction continued on a project previously awarded after activities ceased in October 2007 due to low river levels. Typical structure modifications included reverse sill, dike lowering, and chevrons. The continuing construction in 2008 for Task Order #16 provided for the construction of 32 total structures within Glovers Point, Tyson, and Upper Plattsmouth Bends.

River Mile 653

Photograph 6. Chevron construction at Tyson Bend, May 2008.

Tobacco Bend: Estimated SWH: 5 acres created with a future maximum of 70 acres. Following the design evaluation previously described, improvements were made to the Tobacco Bend chute near RM 588 to restore the original design grade and make minor chute improvements in some areas. Material was excavated in the low-water winter season by the Omaha District's Missouri River Project Office, with disposal on-site in designated areas. Approximately 60,000 to 70,000 cy of material were removed.

River Mile 587

Photograph 7. Dragline at Tobacco Bend chute.

Missouri River Office Structure Modifications: Estimated SHW: 6 acres with a future maximum of 12 acres. The Omaha District's Missouri River Project Office performed channel structure modifications intended to create SWH. The typical chevron consists of two angled legs with an open gap between the legs. Typical modifications consisted of chevron nose filling and chevron leg extensions. Structures were modified within Boyer, Desoto, and Upper and Lower Hamburg Bends. A total of 24 structures were modified.

River Mile 635

Photograph 8. Chevron enhancement, Boyer Bend, May 2008.

River Mile 635

Photograph 9. Boyer Bend, August 2008 showing the modified chevron with filled nose, extended wing, and adjacent rootless dike.

II.B.3. Kansas City District Design Activities

Barney Bend: Estimated SWH: 46 acres. Barney Bend is located on the left bank, with the entrance near RM 550. The plans include the design of a 9,000-foot, flow-through chute. The chute is designed to have four rootless dikes at wide spots along the chute alignment. Construction is on hold pending completion of the National Academy of Sciences sedimentation study.

Wolf Creek: Estimated SWH: 47 acres. Wolf Creek Bend is located on the left bank, with the chute entrance tentatively placed near RM 480. The conceptual design calls for a flow-through chute with an approximate length of 9,000 feet. The project is expected to have multiple entrances, rootless dikes in the chute, woody debris anchored in the chute, and varying cross-sectional shapes, including elevation benches and side slope changes.

Dalbey Bottoms: Estimated SWH: 92 acres with a future maximum in excess of 100 acres. The Dalbey Bottoms site is located on the right bank in the state of Kansas. It has a conceptual design for a chute that would have an entrance at RM 417.5 and an approximate length of 16,000 feet. Conceptual designs for reverse sills, bank notches, and bank erosion would increase the SWH acreage to a total at the site in excess of 100 acres.

Benedictine Bottoms: Estimated SHW: acres to be determined. The Kansas City District is exploring the potential of developing a chute at the Benedictine Bottoms site, RM 426. Discussions continue with the U.S. Army at Fort Leavenworth, Kansas for development at RM 403 and with the Columbia Fisheries office of the USFWS for potential shallow water habitat development projects with these two entities.

II.B.4. Kansas City Construction Activities

Rush Bottom Bend: Estimated SWH: 15.2 additional acres to existing project with a future maximum of 42 SWH acres. The chute project at Rush Bottoms, located at RM 501.5, was completed after delay and with modifications to the original design. The length of the chute was shortened slightly to allow for completion and compliance with the Missouri Clean Water Commission requests. The chute is a 7,376-foot, single entry, flow-through chute.

River Mile 501.5

Photograph 10. Completed chute at Rush Bottom Bend.

Missouri River Office Structure Modifications: Estimated SWH: marginal. Dike notching and lowering were proposed for the 2008 construction season. The notching was to occur between RM 250 and RM 400. The lowering was to occur between RM 300 and RM 400. This work was proposed to help maintain and improve the quality of existing SWH and to create a marginal amount of new SWH. The contract was awarded in the spring of 2008, but no work occurred due to high water levels during the spring. The work is scheduled to begin in February 2009 and be complete in April 2009.

III. Flow Modifications

In December 2008, the Corps' Missouri River Basin Water Management Division (part of NWD) prepared the System 2008-2009 Annual Operating Plan (AOP), which presents information regarding the Corps' regulation of the System through February 2010. The information provided in this AOP is based on water management guidelines designed to meet the regulation objectives of the Missouri River Mainstem Reservoir System Master Water Control Manual (Master Manual). The results of this flow management, with regard to compliance with RPA elements of the BiOp, will be described in the Missouri River Mainstem System Summary of Actual 2008 Regulation report (in press). The System document, "System Description and Regulation," published in November 2007, presents a summary of pertinent data and a description of the System and discusses the regulation of the System to serve the Congressionally-authorized project purposes. The Missouri River Basin Water Management Division, located in Omaha, Nebraska, directs the regulation of the System to serve the Congressionally-authorized project purposes of flood control, navigation, hydropower generation, irrigation, water supply, water quality control, recreation, and fish and wildlife.

III.A. Spring Pulse

The technical criteria presented in the Master Manual includes provisions for two 'spring pulses' out of Gavins Point Dam, one in late March and another in May. These technical criteria also include System storage 'precludes' for each of the spring pulses to be measured on March 1 and May 1 of the year. The spring pulse technical criteria, which was added to the Master Manual in 2006, calls for both these precludes to initially be set at a System storage of 36.5 million acre-feet (MAF) until the first of each pulse is implemented. After the initial year of implementation of either the March or May spring pulse, the preclude for that spring pulse changes to 40 MAF. Storage was below 36.5 MAF on March 1, 2006 and on March 1, 2007, so an initial March pulse had not been implemented. However, the storage was above the 36.5-MAF preclude on March 1, 2008; therefore, a March spring pulse was released in 2008. The March spring pulse, with peak releases of 5,000 cubic feet per second (cfs) above navigation service flows minus the flow from the James River (a net of 4,500 cfs in 2008) coinciding with the start of the navigation season, is of similar magnitude but shorter duration than the channel-conditioning flows used at the start of the navigation seasons in the past. Storage was above 36.5 MAF on May 1, 2006; therefore, a May spring pulse was implemented in 2006, and the storage preclude was increased to 40 MAF for subsequent years. System storage was below 40 MAF on May 1, 2008, so a May pulse was not implemented in 2008. Additional information on the spring pulse criteria is included in the Master Manual or the System document, "System Description and Regulation," published in November 2007 and in the annual AOPs.

Considerable monitoring was conducted by the Corps' Omaha and Kansas City Districts, the USGS, USFWS, and state game and fish agencies to better understand the impacts of the March 2008 spring pulse releases and natural spring rises on the Missouri River from Gavins Point Dam to the mouth. These monitoring efforts and the subsequent evaluation of the data acquired focused on impacts to native river fish (especially the endangered pallid sturgeon), drainage from riparian lands, and groundwater levels adjacent to the Missouri River. Various reports are being, or will be, prepared presenting the findings of these monitoring and evaluation efforts, all of which were conducted as part of the Integrated Science Program of the MRRP (discussed in Section IV, Science of this report).

III.B. Fort Peck Flow Modification and Unbalanced Intrasystem Regulation

The Fort Peck 'mini-test' and unbalancing of the upper three reservoirs were not implemented in 2008 and will not be implemented in 2009 due to low System storage. Both of these flow-modification components may be implemented when System storage recovers to more normal levels. In the meantime, background data on native river fish, especially the pallid sturgeon, are being obtained and evaluated on the river reach downstream from Fort Peck Dam (discussed in Section IVB.5, Fort Peck Biological Monitoring of this report).

III.C. Sediment Studies

III.C.1. The Lewis and Clark Lake Sediment Management Study Update

The Lewis and Clark Lake Sediment Management Study (LCLSMS) was developed to examine the engineering viability of moving deposited sediments from Lewis and Clark Lake into the river downstream of Gavins Point Dam. In the BiOp, the USFWS stated, "*The Corps shall research and develop a way to restore the dynamic equilibrium of sediment transport and associated turbidity in river reaches downstream of Fort Peck, Garrison, Fort Randall, and Gavins Point Dams.*

Sediment bypass around large dams is feasible (Singh and Durgunoglu 1991). Bed degradation below dams and head cutting at the mouths of tributaries might be addressed with grade control structures. Weir notches at grade control structures would allow for fish passage to the tributaries. Because of the large sediment deposition zone at the upper end of Lewis and Clark Lake and its proximity to Gavins Point Dam, Gavins Point may provide the best opportunity for a pilot study (USFWS 2003)."

Initial consideration of using flows through the dam to transport deposited sediment was not strongly supported. Additional research on the System in the Lewis and Clark Lake reach showed that there is the possibility of physically transporting sediments through Lewis and Clark Lake (Engineering and Hydrosystems, 2002). A number of different flow and stage scenarios have been suggested by this research.

With the recommendation for a study at Gavins Point Dam through the BiOp and proof of concept provided by the 2002 Engineering and Hydrosystems study, the LCLSMS was initiated in 2005. The LCLSMS is funded by the MRRP.

Project Goals: The LCLSMS is an engineering viability study. As defined, the study will deal only with the physical processes of hydraulic flow, sediment erosion, sediment transport, and sediment deposition. Environmental, economic, political, and quality of life issues are not considered in the scope of this study. The project goals, as stated in the draft PMP, are:

- Determine the hydraulic capacity to transport sediment in and below Lewis and Clark Lake.
- Develop estimated final reservoir geometries as a result of flow alternatives.
- Determine downstream sediment transport capacity and possible deposition zones.
- Develop a test flow to mimic the hydraulic alternative most likely to result in the desired outcome.
- Protect existing project infrastructure.

Timeline: The LCLSMS project began with the development of the project plan and scope of work for modifying GSTARS3 by the Colorado State University, Hydroscience and Training Center (HTC) in 2005. Award of the work to develop GSTARS3-HTC signaled the beginning of the project in late 2005. The current schedule expects to see the completed project in early 2010.

The LCLSMS project was broken down into seven phases. These phases are:

- Phase 1: Modification of the GSTARS3 Sediment Transport Model to allow for an unsteady-state flow analysis.

- Phase 2: Collection of river and reservoir geometry and sediment samples between Fort Randall Dam and Sioux City. Agency workshop and public meeting to gather input on developing alternatives.
- Phase 3: Verification of the GSTARS3-HTC reservoir model.
- Phase 4: Development and analysis of alternatives using the GSTARS3-HTC reservoir model from Fort Randall Dam to Gavins Point Dam.
- Phase 5: Development of the HEC-RAS v.4 downstream computer model from Gavins Point Dam to Sioux City.
- Phase 6: Implementation of the HEC-RAS model using output files from the GSTARS3-HTC reservoir model.
- Phase 7: Completion of the LCLSMS and recommendation of an alternative for possible further testing. A public/agency meeting will be held to disseminate results during this phase, initially scheduled for the summer of 2009.

III.C.2. 2008 Project Progress

During 2008, work continued on Phases 3, 4, and 5. Through discussion between the Corps' contractor and staff at Colorado State University, new sediment flushing survey datasets were discovered. These datasets are being collected on water storage reservoirs in China and surveyed pre- and post-flush to record changes in reservoir storage and downstream deposition. In an attempt to produce a reservoir model with the least uncertainty possible, the project schedule was modified to include an 8-month extension for additional modeling with these new datasets. This additional calibration will result in a more refined model code, which should give more accurate results when simulating various management activities on Lewis and Clark Lake. This addition will change the project completion date to late spring 2010 with all of the phases staying in the existing order.

Data analysis was completed on the sediment samples collected with the hydrographic surveys and delivered to the Corps' contractor. Additional surveys at Gavins Point Dam were collected in April and July 2008. Data collection of tributary inflows and rating curves was completed, and initial formulation of flow alternatives was achieved.

IV. Science

IV.A. Adaptive Management

In 2008, adaptive management (AM) became a priority for Corps MRRP implementation activities. To address this priority, the Corps and USFWS AM representatives conducted many actions to develop AM activities for BiOp RPA elements, assisted in writing the AM sections of the MRRP Program Management Plan (PgMP) and Integrated Science Program PgMP, engaged with the MRRP Cooperating for Recovery (CORE) Team (the primary decision-making body for the compliance activities within the MRRP) regularly, and provided outreach to a host of other groups on AM in the Missouri River Basin.

The Corps and USFWS selected the Structured Decision Making (SDM) Rapid Prototyping Workshop process (a technique from the National Conservation Training Center workshop) as a means of developing the tools necessary to begin crafting an adaptive strategy for each of the RPA elements. These workshops bring selected groups of persons involved in a difficult management issue together to solve one simple problem within the larger more complex set of problems they deal with on a daily basis. Working through a smaller, tractable problem familiar to the group helps to foster the ability to work together and introduces the participants to the tools and techniques available within the SDM Rapid Prototyping Workshop process.

The ESH AM Team met in the USFWS' National Training Center in Shepardstown West Virginia on January 28 - February 1 and developed its first prototype of the ESH decision-making problem. The team, which included the Corps' MRRP Program Manager, ESH Program Manager, and planning staff; NPS staff; and the USFWS' Missouri River Coordinator and staff-level biologists, crafted its prototype of the

ESH problem into a prototype document that served as the starting place for developing an AM strategy for the ESH Plan for habitat creation activities.

The first draft of an ESH AM Plan was presented to the CORE Team at its meeting in Minneapolis on March 13, 2008. The goal, objectives, actions, decision problem, process, and draft models of the ESH AM Team were discussed and supported by the Core Team. Leadership support for these activities spurred a need to secure support for these activities and contracts were developed with the University of Nebraska at Lincoln (UNL) and Pacific Northwest National Laboratory (PNNL). These contractors were secured in July.

The process of converting the prototype into an AM strategy ensued throughout the summer and fall. Currently, the ESH AM Team is working on the monitoring section of the plan and developing an AM Appendix for the PEIS underway for ESH. The models have been updated, the first scenarios were run, and model results were discussed November 4. Final steps taken in 2008 will be to issue another draft of the ESH AM Plan, with all of the SDM elements in completed form.

The SWH AM Team engaged in a similar process August 11-14 at the Lied Center in Nebraska City. This team was broader than the ESH AM Team and included Corps engineers and biologists; Nebraska, Iowa, and Missouri state biologists; USGS and USFWS personnel; and two representatives from academia. This team is following the same steps and process the ESH AM Team took and will produce similar products. A draft of the Prototype Plan has been reviewed and presented to the CORE Team at a September 17 meeting in Omaha. The tasks remaining in 2008 are to conduct a data-mining exercise and have a meeting in December to discuss the monitoring necessary for the SWH AM Plan.

Other activities conducted under the AM efforts consist of presentations at CORE Team and MRNRC business meetings, development of outreach documents, and presentations to help explain AM in clear and simple terms. Also, the AM Team Leader participated with the AM community-of-practice through meetings and calls with Everglades Restoration, PNNL, and UNL AM experts.

At this time, AM for flow modification is in the thought-process stage. In the meantime, data acquisition and evaluation has been continued in an expanded effort in 2008. As more is learned about the current criteria for the various forms of flow modification and results of flow tests (Fort Peck mini- and full-tests), the need for an extensive data base and evaluation of these data will become more important. Two efforts that have been underway are the fishery monitoring that has been ongoing for several years for the Fort Peck and Yellowstone River reaches and the limited downstream socioeconomic monitoring of the May 2006 spring pulse as it moved downstream from Gavins Point Dam. The Fort Peck and Yellowstone River monitoring and evaluation effort continued in 2008, and an expanded (from mid-March through at least August 2008 instead of just during the movement of a Gavins Point Dam spring pulse release downstream) drainage and groundwater monitoring and evaluation effort for spring rises (increases in flows on the Missouri River reach from Gavins Point Dam to the mouth whether created by Gavins Point spring pulse releases or naturally occurring due to inflows from tributaries of the Missouri River in the reach). A summary of the 2008 monitoring and evaluation of the Fort Peck and Yellowstone River data is included elsewhere in this report. A separate report will be completed for the spring rise monitoring and evaluation effort in early 2009.

IV.B. Pallid Sturgeon Summary

IV.B.1. Population Assessment Program

The Pallid Sturgeon Population Assessment Program was developed by the Pallid Sturgeon Population Assessment Team (Figure 1). The Team is comprised of representatives of State and Federal Agencies and academia that collectively possess knowledge and expertise on the Missouri River, pallid sturgeon and other native Missouri River fishes, research, experimental design, and statistical analysis. The program focuses on the endangered pallid sturgeon and a group of native Missouri River fish species as recommended in the BiOp.

Figure 1. Pallid Sturgeon Population Assessment Team.

IV.B.1.a. Program Objectives

The following are the objectives of the Pallid Sturgeon Population Assessment Program:

1) Evaluate annual results and long-term trends in pallid sturgeon population abundance and geographic distribution throughout the Missouri River system.

2) Evaluate annual results and long-term trends of habitat usage of pallid sturgeon and hatchery-stocked pallid sturgeon by season and life stage.

3) Evaluate population structure and dynamics of pallid sturgeon in the Missouri River system.

4) Evaluate annual results and long-term trends in native target species population abundance and geographic distribution throughout the Missouri River system. These target species include: shovelnose sturgeon (*S. platyorynchus*), blue sucker (*Cycleptus elongatus*),, sauger (*Zander canadense*), plains and Western silvery minnows (*Hybognathus* spp.), sand shiner (*Notropis stramineus*), and three main-channel inhabiting cyprinids in the genus *Macrhybopsis:* sturgeon chub (*M. gelida*), sicklefin chub (*M. meeki*), and speckled chub (*M. aestivalis*). These three chub species are the main forage for piscivorous pallid sturgeon and are rare themselves in some sections of the Missouri River.

5) Evaluate annual results and long-term trends of habitat usage of the target native species by season and life stage.

6) Evaluate annual results and long-term trends in all remaining species (minimum of 50 fish collected/species) population abundance and geographic distribution throughout the Missouri River system.

IV.B.1.b. Program Area and Status Update

Although implementation was initiated in 2001, 2008 marked the third year of full implementation throughout the project area. The project area includes the riverine reaches of the Missouri River extending from Fort Peck Dam, Montana to the confluence of the Missouri/Mississippi Rivers near St. Louis, Missouri and the Kansas River from the Highway 7 Bridge to the confluence of the Kansas/Missouri Rivers (Figure 2). Sampling of pallid sturgeon and target native fish species was conducted by the Montana Fish, Wildlife, & Parks (MTFWP), USFWS-Missouri River Fish and Wildlife Conservation Office, USFWS-Great Plains Fish and Wildlife Management Assistance Office, South Dakota Game, Fish and Parks (SDGFP), Nebraska Game and Parks Commission (NGPC), Missouri Department of Conservation (MDC), and USFWS-Columbia National Fish and Wildlife Conservation Office. All programmatic requirements were met for all segments in 2008 with only two exceptions. During the sturgeon sampling season, high water events prevented deployment of all standardized gear in Segment 10 and reduced the sampling effort in Segments 13 and 14 by approximately one-third. A total of 156 bends were sampled during random and non-random sampling efforts in 2008 (Table 1).

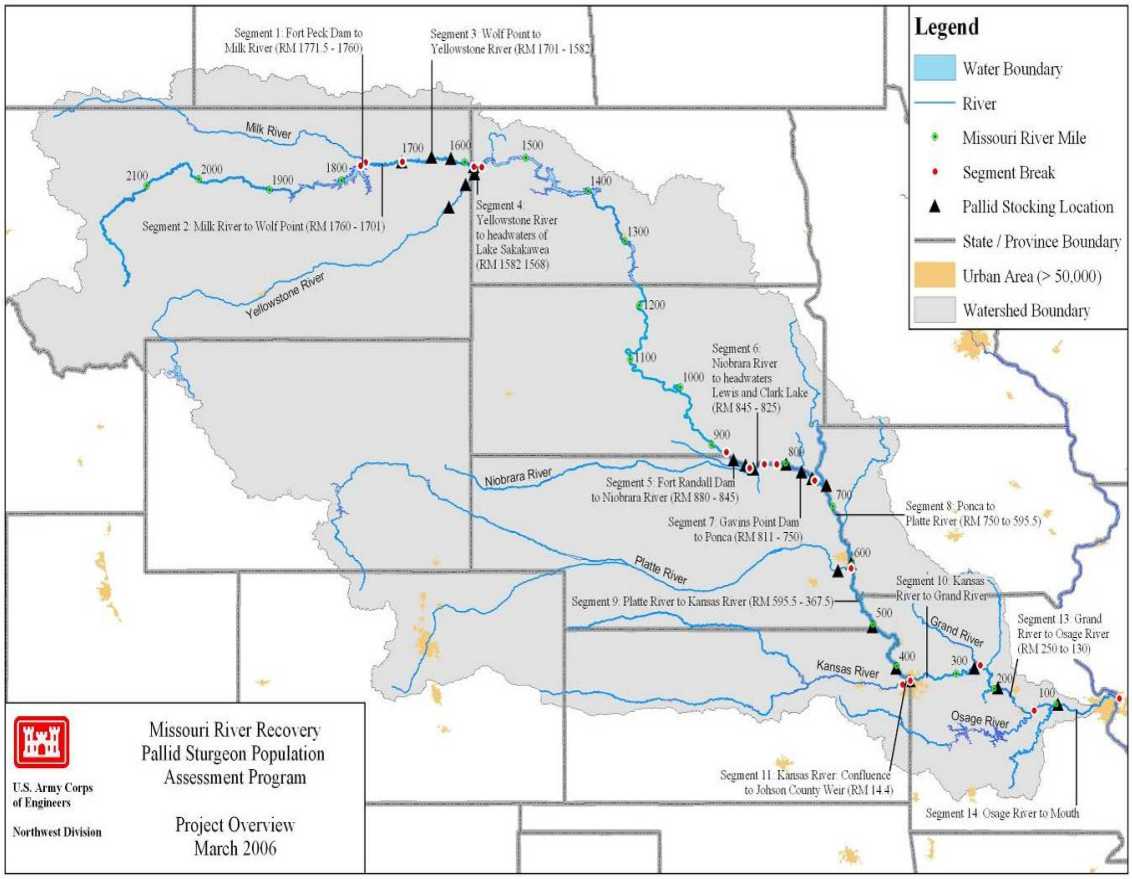

Figure 2. Missouri River Population Assessment Program Map (Segment 12 was combined with Segment 13 effective July 1, 2005).

IV.B.1.c. 2008 Summary Reports

The standardized Summary Reports for each segment (i.e. 1-14) and Comprehensive Project Report will begin to be available on the web (moriverrecovery.org) listed under "Publications and Reports" after March 31, 2009 (Table 1).

Table 1. Pallid Sturgeon Population Assessment Team Members and their Participation in the 2008 Activities			
Agency	Segment(s)	# Bends Sampled (Random plus Non-Random)	Report Availability
Montana, Fish, Wildlife, and Parks	1, 2, & 3	33	Early Spring
USFWS-Missouri River Fish and Wildlife Conservation Office	4	14	Spring
USFWS-Great Plains Fish and Wildlife Management Assistance Office	5 & 6	10	Spring
South Dakota Game, Fish, and Parks	7	30	Mid-Feb.
Nebraska Game and Parks Commission	8 & 9	25	Late Feb.
Missouri Department of Conservation	10 & 11	19	Late March
USFWS-Columbia National Fish and Wildlife Conservation Office	13 & 14	25	Spring

IV.B.2. Propagation and Population Augmentation Project (PPAP)

The Pallid Sturgeon PPAP utilizes six hatcheries throughout the Missouri River basin (Figure 3) to meet the stocking needs of the species. These hatcheries include the Blind Pony State Fish Hatchery (SFH) in Sweet Springs, Missouri; the Neosho National Fish Hatchery (NFH) in Neosho, Missouri; the Gavins Point NFH in Yankton, South Dakota; the Garrison Dam NFH in Riverdale, North Dakota; the Miles City SFH in Miles City, Montana; and the Bozeman Fish Technology Center (FTC) in Bozeman, Montana.

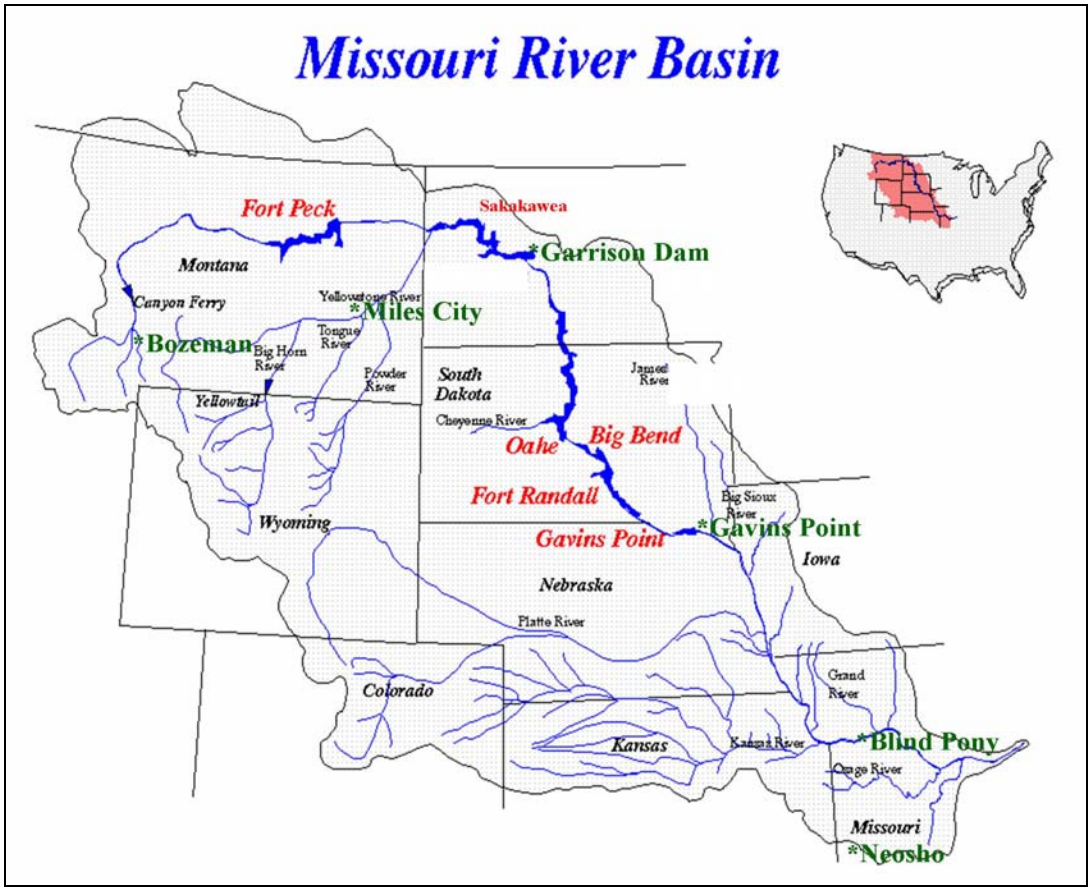

Figure 3. Locations of the Propagation and Population Augmentation Project's Cooperating Hatcheries.

The PPAP consists of two primary hatchery components at the present time. The annual supplemental support component, as derived based on the BiOp, and the facility improvements component, as outlined in the Corps' 2003 Missouri River Biological Assessment (prepared for the BiOp). The annual supplemental support component of the PPAP provides resources to each of the participating hatcheries, as determined by the PPAP's PDT, to ensure the most equitable use of the PPAP's resources to meet the stocking needs of the species. The intent is not to replace resources from these participating hatcheries, but to provide supplemental support to increase the overall capabilities and success of the augmentation effort. The facility improvements component of the PPAP is a short-term approach to addressing limitations of the hatcheries in meeting annual stocking targets. The intent of this component is to increase the quantity and the quality of the hatchery-produced pallid sturgeon to more effectively fulfill the stocking goals in each of the recovery management units for the Missouri River. The facility improvements component has been completed with the exception of addressing reliable power to the Garrison Dam NFH. Currently, the six hatcheries have a collective maximum production capability of approximately 60,000 yearling-sized pallid sturgeon (Figure 4). The combination of these two hatchery components enables the PPAP effort to focus on the population augmentation needs of the pallid sturgeon relative to recovery of the species. Pertaining to all of the hatcheries, a portion of the annual supplemental support offsets costs associated with feed, utilities, distribution costs, water filtration and disinfection, and various maintenance items and operational costs incurred through the hatchery improvements component of the project.

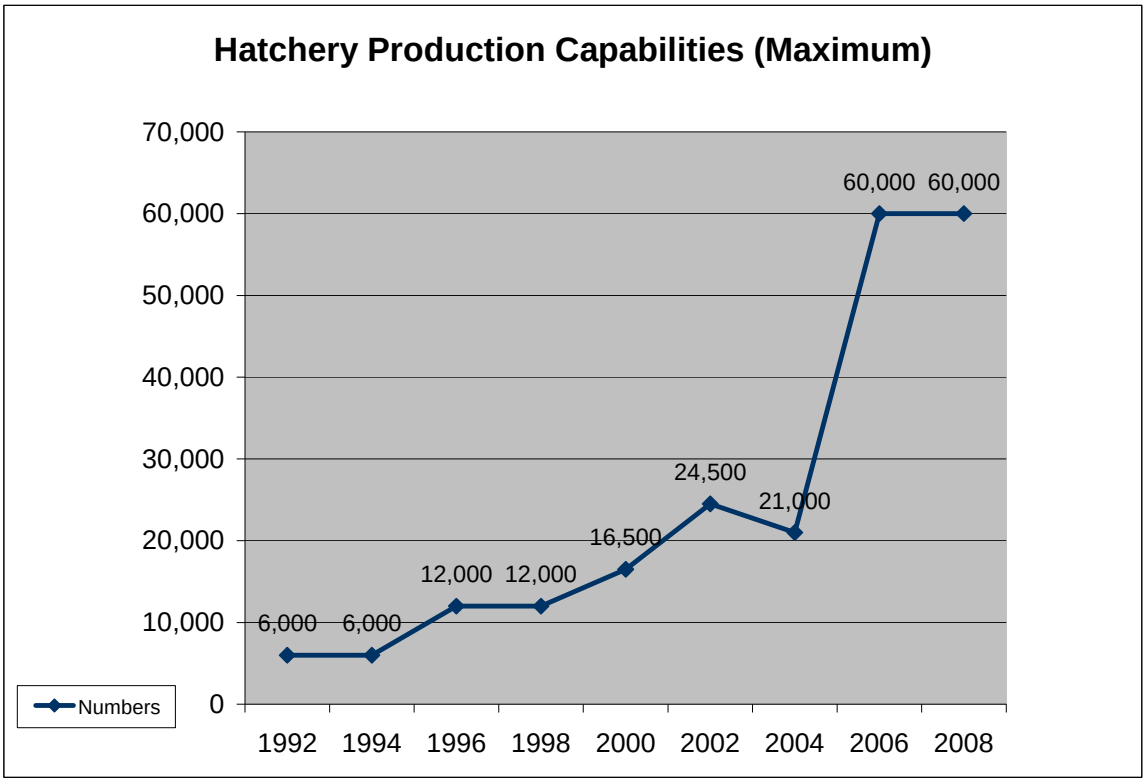

Figure 4. Maximum Hatchery Production Capabilities for the Gavins Point, Garrison Dam, Miles City, Blind Pony, and Neosho Hatcheries and the Bozeman FTC Collectively.

Figure 7 is based on maximum allowable densities of 0.5 pounds of fish per square foot of rearing space and fish length of approximately 8 inches (fork length). Note that the hatcheries will operate at densities below the recommended maximum allowable levels to minimize stress that would likely reduce the overall quality of the fish and potential for successful stocking. The figure was based on 12,000 production fish at the Gavins Point NFH annually, which will decrease over time as additional future captive broodstock will occupy this rearing space, thus reducing production capabilities for stocking. The Recovery Priority Management Areas, referred to in Figure 8, are from the Pallid Sturgeon Recovery Plan and are as follows:

1. The Missouri River from the confluence of the Marias River to the headwaters of the Fort Peck Reservoir;
2. The Missouri River from Fort Peck Dam to the headwaters of Lake Sakakawea, including 71 miles of the Yellowstone River;
3. The Missouri River from Fort Randall Dam to the headwaters of Lewis and Clark Lake; and
4. The Missouri River from Gavins Point Dam to the confluence of the Missouri with the Mississippi River.

All six hatcheries were actively involved in the spawning, rearing, and stocking of pallid sturgeon in 2008. Collectively, 89,701 fingerlings and 19,614 yearlings were stocked into the four Missouri River RPMAs, with the distribution of these pallid sturgeon numbers shown in Figure 5.

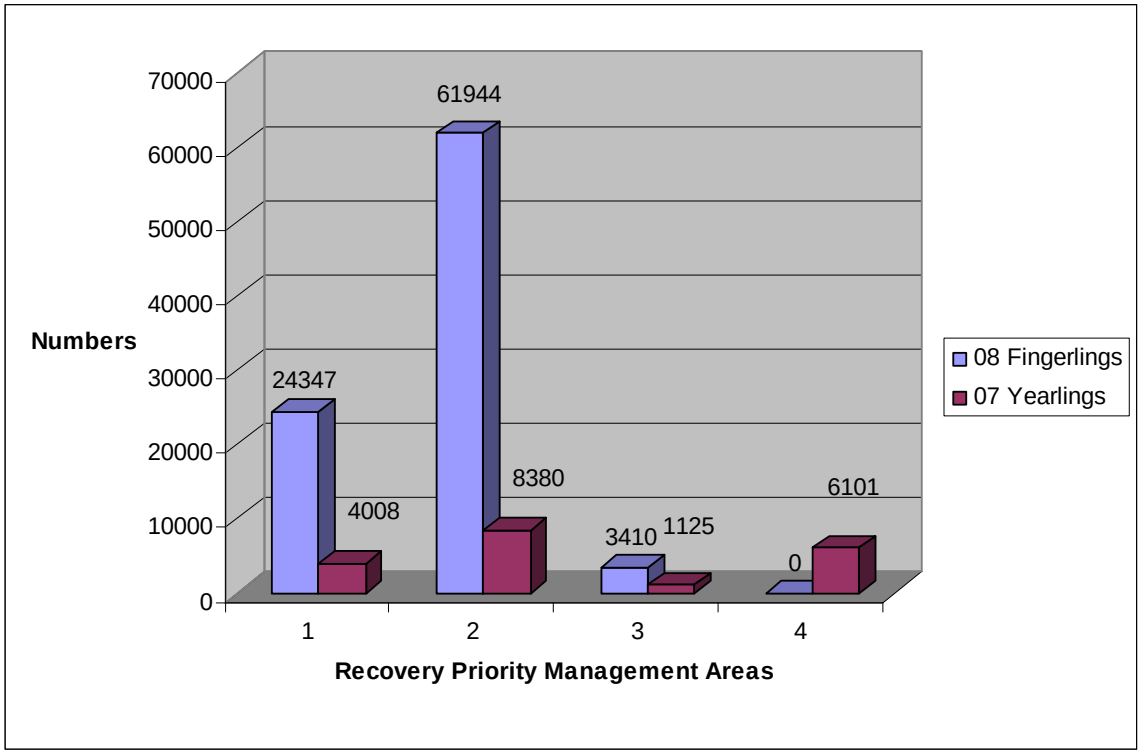

Figure 5. Stocking for the 2007 Yearling and 2008 Fingerling in 2008.

The benefits of a collective approach to capturing, spawning, and rearing pallid sturgeon is critical to the overall success of the PPAP. Intensive broodstock collection efforts were conducted throughout the Missouri River Basin in April and early May. In the upper basin, a multi-agency effort successfully captured adult pallid sturgeon from the Missouri and Yellowstone Rivers near Williston, North Dakota. Six males and two females were transported to the Miles City SFH in Montana, three females and eight males were transferred to the Garrison Dam NFH in North Dakota, and three males and one female were transported to the Gavins Point NFH in South Dakota.

In the middle basin, the NGPC led and coordinated the first intensive broodstock collection effort in the Missouri River below Gavins Point Dam. This multi-agency effort included volunteers from several colleges and universities as well as interested citizens from communities along the river. One hundred sixty-eight pallid sturgeon were captured during this effort, including both wild and hatchery-stocked fish. Of the fish collected, 29 were determined to be reproductively ready (5 females and 24 males) and were transported to Gavins Point NFH and Blind Pony SFH for inclusion in their spawning efforts.

In the lower Missouri River, multi-agency efforts captured adult pallid sturgeon and transported them to the Blind Pony Hatchery and the Neosho National Fish Hatchery in Missouri. The fish being held at the Neosho Hatchery were transported to the Blind Pony SFH resulting in a total of 2 females and 5 males for the spawning effort.

IV.B.2.a. Fish Marking

A variety of marking methods have been utilized to identify hatchery fish, which enhances scientists' understanding of the species (i.e., growth, movement, survival). The Passive Integrated Transponder (PIT) tag provides the maximum amount of information specific to individual fish. Smaller fingerlings (that cannot be PIT tagged based on size) are marked with tags such as an elastomer tag (visual) or a coded wire tag. These tags provide less information but, at a minimum, differentiate between hatchery and wild fish. Genetic analysis is utilized to differentiate between naturally reproduced and hatchery-reared and stocked pallid sturgeon. The use of scute removal was also incorporated into the mix of marking types in 2007. Scute removal is a permanent mark and may be used to quantify PIT tag retention and serve as a secondary mark in conjunction with other marking techniques.

IV.B.2.b. Garrison Dam National Fish Hatchery (Riverdale, North Dakota)

The Garrison Dam NFH successfully spawned 3 females and 8 males, producing 10 families; only two of the females produced viable fry. Samples of non-viable fry were preserved and will undergo histological evaluation to examine causes that led to a lack of developmental features in the progeny. Four additional families were created using cryopreserved milt with the resulting fry incorporated into the production lots. Spawning efforts for the 3 female fish yielded 539,000 eggs. Luteinizing Hormone-Releasing Hormone analogue (LH-RHa) was utilized to induce ovulation and spermiation in female (0.05 milligrams [mg]/kilograms [kg] of body weight) and male (0.02 mg/kg of body weight) pallid sturgeon, respectively. Milt from 8 males was added to the cryopreservation repository for a total of 127 (98 unique and 29 repeats) on station. In addition to the eggs spawned on station, 43,405 eggs were received from the Miles City SFH for production purposes and to ensure these families were held at multiple locations serving as a backup. A series of fish feeds were fed including Otohime and Silver Cup #2 Salmon. The Garrison Dam NFH's water supply is the Missouri River (Lake Sakakawea), with mean monthly water temperatures ranging from 10.6 degrees Celsius (°C) to 22.2°C, with the coldest temperature in April and the warmest temperature in May. The water is filtered to 40 microns and treated via ultraviolet disinfection exceeding 100,000 microwatt-sec/centimeter (cm). The water is also heated to provide temperatures suitable for successful spawning and rearing of pallid sturgeon.

Survival of 2008 pallid progeny from hatch through fall stocking averaged 74%; the survival of progeny from the two females spawned at Garrison was 86% and 70%. The survival of progeny from the eggs of two female fish received from Miles City SFH was 53% and 50%.

The facility underwent routine fish health testing, and the results were negative for iridovirus for the fourth consecutive year. Facility improvement for 2008 included the replacement of a variable-frequency drive to control the pump in the Sturgeon Building and adding redundancy to the water treatment system by providing a supplemental (backup) boiler, UV disinfection system, pump, and filter.

Production of yearling pallids for summer stocking occurred in 2008 to provide fish for research. Radio transmitters were implanted in the approximately 300 millimeters (mm) (12") fish with 50 fish each stocked at selected sites in the Yellowstone and Missouri Rivers to examine movement and habitat use. The theory that spring stocked fish are more susceptible to downstream movements than summer stocked fish is also being evaluated with these yearling fish. A total of 1,855 fish were released as part of the research effort.

The 2008 stocking effort of Garrison Dam NFH exceeded those of previous years. Spring stocking of yearling pallid sturgeon in RPMAs 1, 2, and 3 totaled 6,297 fish. In summer, 1,655 yearling fish were stocked in RPMA 2 followed by fall stockings of 54,723 fingerling pallids in RPMAs 1 and 2. The facility

also stocked out 61,344 fry in RPMAs 1 and 2. Overall, 62,675 yearlings and fingerlings and 61,344 fry were stocked from the Garrison Dam NFH into the Upper Missouri River Basin in 2008.

IV.B.2.c. Miles City State Fish Hatchery (Miles City, Montana)

The Miles City SFH spawned two female pallids in 2008. The eggs were crossed with 6 males, producing a total of 6 families. A total of 190,787 eggs were collected as a result of the onsite spawning efforts. LH-RHa was utilized to induce ovulation and spermiation in female (0.05 mg/kg of body weight) and male (0.02 mg/kg of body weight) pallid sturgeon, respectively. Egg hatch rate was 80 percent. In addition to the eggs retained on station, the Miles City SFH shipped eggs to the Garrison Dam NFH, the Gavins Point NFH, and the Bozeman FTC for production and research needs. The Miles City SFH continues to be successful at egg production and hatching eggs to fry, but encounters problems getting newly hatched fry to survive to the feeding and later life stages. Fish feeds used for pallid sturgeon included Otohime B-1 and B-2 and Silver Cup #1 and #2.
The primary water source for the hatchery is pumped from the Yellowstone River. All Yellowstone River water used for pallid culture is filtered to 21 microns through rotating drum filters and ultraviolet disinfected to protect the fish from potential parasite and/or disease infestations. Depending on the time of year, the water may be heated (boiler) or cooled through a chiller to provide optimum temperatures for spawning and rearing pallid sturgeon. The hatchery has a small well that provides the ability to moderate water temperatures during the summer months when the Yellowstone River temperatures exceed the temperature range for rearing pallid sturgeon. A large chiller was incorporated into the infrastructure of the Miles City SFH in 2004. Due to the large size of this unit, the existing backup generator is not adequate to run the chiller in the event of a power outage. In 2007, a smaller, portable chiller unit was installed to provide moderated water temperatures. This unit has been tested and is supplied with power from the backup generator during outages. Although this unit does not provide the quantities of water needed to meet the facilities' production needs, it provides stable water temperatures to the critical life stages (eggs and fry) where temperature spikes have caused mortality in the past. The new chiller has been an essential addition to the Miles City SFH to enable the staff to reliably raise pallid sturgeon. In 2008, Miles City SFH installed a backup water tank system that will supply filtered, cooled water to incubating eggs and fry should a power outage occur.

Outside culture of young pallids was conducted in 2008. Approximately 1,900 pallids measuring between 4" and 5" were placed into a one-half acre lined pond in April. Iridovirus testing was conducted in June and the fish were planted in July. Bird netting was installed to control predation and aqua shade was used to control vegetation and to limit light penetration. The biggest challenge in using this culture method was predation by raccoons when fish were in the catch basin—several hundred were lost in one night. In the future, methods that limit this type of predation will be used in conjunction with outside culture activities.

The facility is holding approximately 1,250 fingerlings for advanced rearing and stocking in spring 2009.

IV.B.2.d. Bozeman Fish Technology Center (Bozeman, Montana)

The Bozeman FTC received eggs representing 9 lots from the successful spawning efforts at the Miles City SFH and the Garrison Dam NFH. A variety of fish feeds were utilized at the facility, including Otohime, Cyclo-peeze, and Silver Cup. The Bozeman FTC's water sources include a cold spring (8°C), a warm spring (22°C), and a warm well (22°C). Water temperatures within the rearing tanks ranged from 16°C to 22°C. These water sources were mixed to provide the desired temperatures for rearing pallid sturgeon. Water treatments include bio-filters, sand filters, ultraviolet disinfection at 100,000 microwatt-sec/cm2, and packed columns.

The Bozeman FTC stocked 1,248 yearling and 5,437 fingerling pallid sturgeon in the Missouri River above Fort Peck Reservoir. Below Fort Peck Dam, including the Yellowstone River, 1,906 yearling and 8,370 fingerling pallid sturgeon were stocked. The facility also stocked out 28,515 fry (approximately 20 days of age) into the Missouri River above Fort Peck Reservoir and 4,484 into the Yellowstone River near Miles City, Montana.

The Bozeman FTC staff conducted diet development studies in 2008 to find a replacement diet for BioDiet, the standard propagation diet that is no longer produced. In 2007, Bozeman FTC reported at the MRNRC and the BiOp meeting in 2008 that Otohime appeared to be a suitable replacement diet and have continued studies with Otohime and other diets and diet combinations (Otohime and Cyclopeze etc.). Results from 2008 studies are pending at this time. These studies are funded by WAPA and the Bozeman FTC.

IV.B.2.e. Gavins Point National Fish Hatchery (Yankton, South Dakota)

In 2008, 2 female pallid sturgeon from the captive broodstock at the facility were spawned and crossed with 3 males, resulting in 3 families and a total of 48,000 eggs. Approximately 12,000 of those eggs were shipped to the USGS Columbia Environmental Research Center for research activities. Nearly 80% of the captive broodstock eggs at Gavins Point NFH were successfully hatched at the facility, but did not survive past 10 days as fry. However, the USGS did have survivability success from the captive broodstock eggs. There were 23 additional captive males from the 1997-2001 year class that were spawned and 9 of those males were successfully cryopreserved. This success marks consecutive years that male broodstock have been utilized successfully to create viable progeny. The facility also attempted to spawn three wild females from the middle basin broodstock with no success. The lack of success is credited to a decrease in water temperatures from the lake water source during these critical spawning times. The Gavins Point NFH also successfully spawned 12 of 20 males from the middle basin. The facility received 73,507 eggs from the Garrison Dam NFH and 35,637 from the Miles City NFH, representing 9 families, for production and for incorporation into the future captive broodstock.

LH-RHa was used to induce ovulation in the females (10 mg/kg of body weight) and spermiation in the males (.01 mg/kg of body weight). Overall, egg hatch was good with high variability between individual families, ranging from 1 to 95 percent. Family hatching success was similar to other facilities. A variety of fish feeds were utilized, including Silver Cup Salmon, Gemma, and Cyclo-peeze, in addition to rainbow trout for the captive broodstock and wild broodstock held on station for spawning purposes.

Water sources for the hatchery include three cold water wells and surface water from the Missouri River. The well water is untreated; however, the Missouri River water is filtered through rotating drum filters and treated with ultraviolet disinfection at a rate of 100,000 microwatt-sec/cm2.

The facility stocked 955 yearlings in the Yellowstone River, 525 in the Missouri River below Fort Randall Dam, 927 below Fort Peck Dam, and 835 below Gavins Point Dam. The facility also stocked 9,030 fingerlings into the Yellowstone River and 8,731 and 3,410 to the Missouri River below Fort Peck Dam and Fort Randall Dam, respectively. The Gavins Point NFH retained 579 yearlings as part of the captive broodstock. Fish stocked in 2008 tested negative for iridovirus, and the facility will be tested again for iridovirus in 2009.

IV.B.2.f. Neosho National Fish Hatchery (Neosho, Missouri)

In 2008, the staff was actively involved in the propagation effort. The crew made multiple trips to transport seven (5 males and 2 females) wild broodstock from the Missouri River to the Neosho NFH. The fish were transferred to Blind Pony SFH where the Neosho NFH assisted with spawning and later received pallid sturgeon fry from Blind Pony SFH that will be used for stocking and augmentation in the lower Missouri River (i.e., below Gavins Point Dam). Hatched brine shrimp, adult brine shrimp, and bloodworms were utilized rather than commercial fish feeds.

The Neosho NFH is supplied with water from a spring and well. A portion of the water is heated to provide suitable rearing temperatures for pallid sturgeon. Also, a portion of the water is re-circulated to maximize the use of the heated water. All re-circulated water is ultraviolet disinfected to minimize the potential for disease and parasite transmission between tanks. The facility expansion is now finished with all electrical and water supply infrastructure in place. This new building quadruples the production capacity of the facility from its previous capability. Security measures for the hatchery water source were also completed in 2008.

During 2008, the Neosho NFH stocked 800 yearlings averaging 9.5 in. in length into the middle Missouri River (RPMA 4) and carried over 1,100 yearlings from 2007 spawning activities that will average over 13 in. in length when they are stocked in 2009; some of these fish are being utilized for a tag retention evaluation. The facility also holds 2,220 pallid yearlings from 2008 spawning activities that will also be stocked in 2009.

IV.B.2.g. Blind Pony State Fish Hatchery (Sweet Springs, Missouri)

The Blind Pony SFH successfully spawned 2 females and 4 males, producing 6 families. LH-RHa was used to induce ovulation in the females (0.10 mg/kg of body weight) and spermiation in the males (0.10 mg/kg of body weight). Collectively, nearly 39,000 eggs were collected during the spawning effort. Egg hatch success rate was not measured. Sperm from four male fish was cryopreserved and the straws transferred to Warm Springs Fish Technology Center in Warm Springs, Georgia. A Columnaris outbreak at the Blind Pony SFH was treated four times with oxytetracycline (OTC) at a rate of 20 parts per million and resulted in a complete cure.

In 2008, the staff was actively involved in the propagation effort. The crew made multiple trips to transport wild broodstock from the river to the Neosho NFH. The Blind Pony SFH stocked 4,466 fingerling pallid sturgeon at four locations in RPMA 4. In addition to the stocked fish, 3,009 fry were transported to the Neosho NFH.

IV.B.3. Research Program

The 2008 Research Program worked to develop a process that provides focus, independence, and scientific rigor to the research work funded through the Corps. The budget for research was reduced in 2008, and the Corps worked closely with the USFWS to review research activities to be funded with 2008 dollars. A new Research Program activity for 2008 was the development of the ability to use a more transparent acquisition tool to secure research products. Specifically the Corps worked with Contracting staff and management to develop a Request for Proposals (RFP) process to secure research for the MRRP. The first RFP was initiated in August and closed in October 2008. The Source Selection Board for the first contract met to review proposals in November, and this contract should be in place by early 2009.

The Corps has the following multi-year projects still underway:

- Development of Management Tools for the Pallid Sturgeon Iridovirus – Bozeman Fish Technology Center. Report is due 2009.
- Vulnerability of Age-0 Pallid Sturgeon to Fish Predation – South Dakota State University (SDSU) and USFWS. Report is due 2010.
- Fishing for Cytokines and Immune Molecules to Better Understand Pallid Sturgeon Health – Bozeman Fish Technology Center. Report is due 2008.
- Quantification of Pallid Sturgeon and Shovelnose Sturgeon Trophic Position in the Upper Missouri River – SDSU and USFWS. Report is due 2010.

IV.B.3.a. Comprehensive Sturgeon Research Project (CSRP)

The 2008 Comprehensive Sturgeon Research Project (CSRP) was a combination of two projects initiated in 2006, the CSRP and the Spring Rise Flow Modification (SRFM). Most of the tasks funded in 2007 under CSRP were continued and some of the more important elements of the SRFM rounded out the 2008 effort. An Independent Scientific Review of the entire CSRP project took place in January 2008. Results of this review were used to inform 2008 research decisions and activities. Specific elements of the CSRP for 2008 were as follows:

- Task 1 - Document movement, habitat use, and reproductive behavior of shovelnose and pallid sturgeon in the Missouri River;
- Task 2 - Describe the reproductive physiology of pallid sturgeon prior to and after successful and unsuccessful spawning;

- Task 3 - Determine the habitat characteristics used by sturgeon for spawning, quantity of spawning habitat available (Availability and Change at the Patch Scale), and dynamics of habitat change related to varying discharge, sediment transport, and water quality;
- Task 4 - Effects of flow and water temperature on spawning, growth, and recruitment of pallid sturgeon and shovelnose sturgeon in the Missouri River below Gavins Point Dam; and
- Task 6 - Provide database integration, GIS support, and report coordination for all aspects of this scope of work and the research support for the Fort Peck Flow Modification Biological Data Collection Plan.

The summaries from 2008 data are being produced by the USGS and the NGPC. Results will be published in data reports to the Corps and in peer-reviewed journal articles.

IV.B.3.b. Pallid Sturgeon Workshop

Findings from the pallid sturgeon workshop were published in the May 2008 workshop report. The workshop, put together by a steering committee, was held in St. Louis, Missouri July 31-August 2, 2007. Experts from within and without the basin were invited. Fifty nine technical experts and 28 public observers attended. The purpose was to consider existing information and work to develop technical guidance on prioritized research and management strategies to assist in recovery of the pallid sturgeon.

IV.B.4. Habitat Assessment Monitoring Program

The Pallid Sturgeon Habitat Assessment and Monitoring Program (HAMP) began in 2004 and has been developed by the HAMP Team. The HAMP Team is comprised of representatives of State and Federal Agencies and academia that collectively possess knowledge and expertise on the Missouri River, pallid sturgeon and other native Missouri River fishes, research, experimental design, and statistical analysis. This team includes the MDC, University of Missouri, USGS, USFWS, Iowa Department of Natural Resources, NGPC, SDGFP, Corps, and others. The HAMP focuses on the endangered pallid sturgeon and a series of native Missouri River species and their habitats, as recommended by the BiOp.

IV.B.4.a. Program Goal

The goal of the HAMP is to assess the physical and biological responses to habitat creation actions that are expected to benefit pallid sturgeon and related communities. More specifically, the HAMP addresses the following questions:

1. Assess and monitor the physical changes between control bends and modified bends:
    a. Is there any physical difference between the constructed sites and the controls site?
    b. Do the constructed habitat sites have more physical value than the control sites?
2. Assess and monitor pallid sturgeon response and other biological changes between control bends and modified bends:
    a. Is there any differences in native target species (i.e., young-of-year [YOY] and juvenile pallid sturgeon, young-of-year (YOY) and juvenile shovelnose sturgeon, sicklefin chubs, sturgeon chubs, speckled chubs, plains and western silvery minnow, YOY and juvenile blue sucker, and sauger) relative to species composition, richness, and relative abundance between the constructed sites and the control sites?
    b. Are native target species (i.e., YOY and juvenile pallid sturgeon, YOY and juvenile shovelnose sturgeon, sicklefin chubs, sturgeon chubs, speckled chubs, plains and western silvery minnow, YOY and juvenile blue sucker, and sauger) composition, richness, and relative abundance greater at the constructed sites than at the control sites?

IV.B.4.b. Program Status Update

Work completed for the HAMP during the 2008 sampling season includes the collection of both biological and physical data at the bend level consistent with the study design. The HAMP is designed to assess the affects of habitat creation activities on physical habitat availability and the response of the biological community at the bend level. It uses an upstream/downstream strategy to assess the affects of differing

hydrographs. The HAMP biological sampling was conducted by the NGPC in the Omaha District and the USFWS - Columbia, MO Field Research Office in the Kansas City District. Sampling began on April 15 and continued through October 15, 2008.

Biological sampling consisted of deploying all three standard gears within all study bends, which resulted in approximately four visits per study bend with each standard gear throughout the year. The study design includes 20 bends in the upper segments (Segments 8 and 9) of the Omaha District and 18 bends in the lower segments (Segments 10, 13, and 14) in the Kansas City District. High water and inundation of the floodplain occurred from late May through mid July from the Platte River in Nebraska to the mouth; therefore, due to safety concerns and issues of sampling in high water conditions, sampling was not completed on any study bends in the lower portion (Segments 10, 13, and 14, below Kansas City, MO) of the Missouri River during this time period.

Interesting observations worth noting for 2008:

USFWS (Kansas City to St. Louis, MO)

- Collected multiple YOY *Scaphirhynchus* spp. (< 55 mm). These individuals are currently being held for genetic identification to determine whether they are pallid or shovelnose sturgeon. Similar to previous years, YOY sturgeon are being collected late in the sampling season (e.g., September and October). Collection of these small sturgeon indicate spawning is occurring throughout the summer and early fall.

- Collected several flathead chubs (rare native species in the lower Missouri River)

- Collected YOY *Hybognathius* spp. (mostly identified as plains minnow). This is the first year multiple YOY *Hybognathius* spp have been collected.

- Conducted night push trawling trials on channel sand bars. This limited effort resulted in the collection of one pallid sturgeon (the first pallid sturgeon the HAMP has collected with the push trawl), adult blue sucker, and several YOY/juvenile shovelnose sturgeon (< 200 mm). This preliminary effort has also resulted in some interesting results, providing insight about SWH use at night by target species.

- Collected high numbers of YOY channel catfish, drum, chubs, and bighead and silver carp compared to previous years sampling. Catch rates of these species have increased dramatically in September compared to the rest of the summer.

NGPC (Ponca, NE to Kansas City)

- Collected double the number of YOY *Scaphirhynchus* spp. (< 55 mm) than in past years. Similar to the USFWS crews, these individuals are currently being held for genetic identification to determine whether they are pallid or shovelnose sturgeon.

- Collected fish species that have not been collected in Nebraska waters since the late 1800's/early 1900's (i.e., black sided darter), as far as is known at this time.

- Collected fish species not collected by NGPC crews since the HAMP was established (i.e., flathead chub, a species of concern and YOY bighead and silver carp, nonnative invasive species of the Mississippi and Missouri River drainages).

- Collected similar number hatchery and adult pallid sturgeon compared to previous years.

- Collected high numbers of small drum, blue catfish, and channel catfish compared to previous years with lower water conditions.

- Observed increased top-width in some areas where high water was present, but at very small magnitude in relation to the HAMP goals.

IV.B.5. Fort Peck Biological Monitoring

The BiOp identified that seasonally atypical discharge and water temperature regimes resulting from operations of Fort Peck Dam have precluded successful spawning and recruitment of pallid sturgeon *Scaphirhynchus albus* in the Missouri River below Fort Peck Dam. In response, the Corps is investigating the potential to modify flow releases from Fort Peck Dam to enhance environmental conditions for spawning and recruitment of pallid sturgeon. Flow modifications include releasing warm surface water over the Fort Peck Dam spillway. The Fort Peck Flow Modification Biological Data Collection Plan (hereafter Fort Peck Data Collection Plan) was initiated in 2001 to evaluate the influence of proposed flow and temperature modifications on physical habitat and biological response of pallid sturgeon and other native fishes. Baseline research, monitoring, and evaluation activities have been conducted annually since 2001.

During 2008, the Corps supported the Fort Peck Data Collection Plan to include the following activities: 1) measure water temperature and turbidity at several locations in the Missouri River downstream from Fort Peck Dam and in off-channel and tributary locations; 2) implant adult pallid sturgeon, paddlefish *Polyodon spathula*, blue suckers *Cycleptus elongatus*, and shovelnose sturgeon *Scaphirhynchus platorynchus* with radio transmitters, examine movements, and relocate these species in the Yellowstone River and Missouri River between Fort Peck Dam and Lake Sakakawea; 3) quantify larval fish distribution and abundance at sites in the Missouri River below Fort Peck Dam, selected tributaries, and off-channel areas; 4) quantify the reproductive success of shovelnose sturgeon and pallid sturgeon, based on captures of YOY sturgeon; and 5) assist in the collection of adult pallid sturgeon for the Pallid Sturgeon Propagation and Population Augmentation Project. Activities associated with the Fort Peck Data Collection Plan were jointly implemented by the MTFWP and the USGS - Columbia Environmental Research Center. Similar to 2001 through 2007, proposed flow modifications were not implemented in 2008 due to insufficient water levels in Fort Peck Reservoir.

For research component 1, water-temperature loggers were deployed from April through October 2008. Whereas, data collected in 2008 has not been analyzed because the data collection period was just completed, compilation and evaluation of the 2007 data were completed during 2008 and summarized as follows. In the free-flowing Missouri River upstream from Fort Peck Reservoir at Robinson Bridge, mean water temperature was 17.6°C, and maximum water temperature was 27.6°C. Below Fort Peck Dam, water temperature averaged 12.2°C, and maximum water temperature reached 17.0°C. Thus, river impoundment and hypolimnetic releases suppressed mean water temperature by an average of 5.4°C and maximum water temperature by 10.6°C. Mean water temperature increased as distance from the dam increased and reached 16.4°C at a site 180 miles (290 kilometers) downstream from the dam. This site was the most-downstream Missouri River location prior to receiving inputs from the Yellowstone River. Across all sites, mean water temperature was greatest at Robinson Bridge in the free-flowing reach upstream from Fort Peck Reservoir (17.6°C), followed by the site downstream from the Yellowstone River (17.2°C) near Williston, North Dakota (17.1°C), and in the Yellowstone River (17.0°C). The site below Fort Peck Dam represented the coldest site (mean = 12.2°C).

Data from turbidity loggers deployed during April through August 2008 are being compiled and evaluated. However, evaluation of turbidity data collected during 2007 was completed during 2008. Turbidity (nephelometric turbidity units, NTU) tended to be greater in the Yellowstone River (median = 243 NTU; 25-75% quartiles 65-566 NTU) than in the Missouri River (median = 132 NTU; 25-75% quartiles 76-322 NTU). Turbidity in both rivers varied substantially during the deployment period and exhibited the tendency to increase during elevated discharges and decrease during periods of declining or low flows.

Under research component 2, extensive radio tracking of the Missouri River from Fort Peck Dam to the headwaters of Lake Sakakawea and in lower Yellowstone River was conducted between April and November 2008. These data are currently being compiled and evaluated. However, evaluation of

telemetry data collected during 2007 was completed in 2008 and is summarized as follows. Manual tracking and ground-based telemetry stations resulted in a total of 1,144 relocations of blue suckers, 298 relocations of paddlefish, and 881 relocations of shovelnose sturgeon. In addition, a total of 620 relocations of pallid sturgeon was obtained from this project and from a companion study entitled "Spawning and Associated Movements of Pallid Sturgeon in the Lower Yellowstone River".

Shovelnose sturgeon (N = 42) use of the Missouri River between Fort Peck Dam and Wolf Point, Montana was stable through April and May. Use of this reach declined slightly in June and early July and increased slightly throughout the remainder of the tracking season; however, a minimum of 31% of the shovelnose sturgeon remained in this reach for the duration of the season. The percentage of shovelnose sturgeon relocations in the Yellowstone River steadily increased from early-April (26%) through late-July (62%). Use of this reach declined in August to 22% of individuals and then increased slightly through the end of the tracking season. The lower Missouri River reach from Wolf Point to the headwaters of Lake Sakakawea is twice as long as the other two reaches. However, this reach exhibited the lowest relative abundance of shovelnose sturgeon. Less than 10% of implanted individuals were relocated in this reach in May and June. A maximum of 46% was found during early September as most shovelnose sturgeon had emigrated out of the Yellowstone River.

The distribution and relative abundance of blue suckers (N = 50) varied among rivers through time. During April, blue suckers primarily used (98% of individuals) the Missouri River between Fort Peck Dam and Williston and most were relocated upstream from Wolf Point. The percentage of blue suckers relocated in this reach declined to 45% in early-July and then began to increase. The increased relative abundance of blue suckers in the reach from late-July to late-September was due to movements of blue suckers out of the Yellowstone River, when discharge was low and water temperature was high. The occurrence of blue suckers in the Milk River was dependant on discharge. Approximately 10% of blue suckers entered the Milk River in late-April; however, most forays were of short duration. Many fish entered the Milk River, as indicated by our ground-based telemetry station during a large pulse of water in late-May. The residence time of blue suckers in the Milk River spanned up to 4 weeks for some individuals and was directly related to the decrease in flow. Ground stations indicated that 31% of the implanted blue suckers were in the Milk River during the first week of June. Use of the Yellowstone River by radio-tagged blue suckers exhibited a distinct pattern among tracking periods. Relative abundance of blue suckers in the Yellowstone River was low in April (2%) but steadily increased through May and June. The highest numbers of this fish (48%) were found in the Yellowstone River in early July. Individuals began emigrating out of the Yellowstone River in mid-July and continued their emigration through October.

The transmitters that were implanted in paddlefish below the confluence in 2001 and 2002 were expiring throughout the 2006 and 2007 tracking seasons. Thus, contacts from ground-based telemetry stations and manual relocations were not frequent enough to determine exact times of fish immigrating or emigrating from particular rivers; however, river selected was able to be determined. Despite inter-annual variation in flows, 96% of paddlefish (N = 23) implanted below the confluence selected the same river for their spawning migration. Only one individual selected the Missouri one year and the Yellowstone 2 years later. Ninety-two percent of paddlefish implanted in the Missouri River above the confluence (N = 14) returned to the Missouri or Milk Rivers in subsequent spawning migrations. Only one fish selected the Yellowstone over the Missouri River one year. Thus, it is unlikely that a flow modification in the Missouri River would result in less fish ascending the Yellowstone River.

Pallid sturgeon (N = 15) use of the Missouri River upstream from the Yellowstone River confluence was minimal. The one individual that was implanted in the tailrace immediately downstream from Fort Peck Dam remained in the Missouri River until early June and then migrated into the Yellowstone River for 3 weeks and then migrated back up to the tailrace in the fall. In general, there was inverse pattern for pallid sturgeon between the Yellowstone River and Missouri River below the Yellowstone River confluence. Pallid sturgeon use of the Missouri River below the Yellowstone River confluence declined though early-April as individuals immigrated into the Yellowstone River. Pallid sturgeon primarily used the Yellowstone River through early-July and then emigrated from the Yellowstone River back to the Missouri River below the confluence through the end of the tracking season. Two telemetered female pallid sturgeon were confirmed to have spawned in the Yellowstone River in 2007.

Five pallid sturgeon were implanted during spring brood-stock collection efforts. During September 2007, radio transmitters were implanted in an additional 15 shovelnose sturgeon and 16 blue suckers. These individuals, added to the existing population of implanted fish, will be relocated during the next few years to ascertain discharge and temperature-related movement patterns and aggregations prior to, during, and after proposed flow changes are implemented.

Intensive larval fish sampling associated with research component 3 was conducted between late-May and early-August 2008. Larval fish samples from all sites (Missouri River below Fort Peck Dam, Missouri River near Wolf Point; Missouri River near Nohly, Montana; Milk River, Yellowstone River; and spillway channel of Fort Peck Dam) are currently being processed and enumerated. Larval fish data collected during 2007 were analyzed during 2008 and are summarized as follows. A total of 2,011 larval fish samples and 8,525 larvae were obtained between late-May and early-August 2007. Ten fish families were identified in the samples. Taxa from Catostomidae, Cyprinidae, and Hiodontidae composed 61%, 22%, and 9% of all larvae, respectively. A total of 298 Acipenseriform larvae were sampled across sites, and these represented 28 *Scaphirhynchus sp*. larvae, 263 Polyodontidae larvae, and 7 larvae that could not definitively be distinguished as *Scaphirhynchus sp*. or Polyodontidae. Larval *Scaphirhynchus sp.* were sampled from the Yellowstone River and two sites (Wolf Point, Nohly) in the Missouri River.

Reproductive success of shovelnose sturgeon and pallid sturgeon was assessed under research component 4 from mid-July through early-September 2008. Similar to other research components, data from 2008 are being processed and analyzed. However, trawling data from 2007 were analyzed during 2008 and summarized as follows. A total of 504 trawls was conducted during 2007 on nine sampling events between July 11 and September 6. A total of 126 YOY *Scaphirhynchus sp*.was sampled across all sites: 2 individuals were sampled in the Missouri River upstream from the Yellowstone River confluence, 107 individuals were sampled in the Missouri River downstream from the Yellowstone River confluence, and 17 YOY sturgeon were sampled in the Yellowstone River. Genetic analysis of YOY *Scaphirhynchus sp*. sampled during 2007 is in the final stages of completion, and a report on these fish .should be received by the end of November 2008. Tissue samples from YOY *Scaphirhynchus sp*. sampled in 2008 have been shipped to the USFWS Conservation Genetics Laboratory (Lamar, Pennsylvania) for genetic differentiation of shovelnose sturgeon and pallid sturgeon.

As part of research component 5, assistance was provided during the spring and fall of 2008 to catch adult pallid sturgeon for the pallid sturgeon PPAP. Adult pallid sturgeon captured in the Yellowstone River and Missouri River downstream from the Yellowstone River confluence were assessed by hatchery personnel and reproductive physiology experts to determine suitability for propagation.

IV.B.6. Lower Yellowstone Project (Intake Dam)

Authority for the Lower Yellowstone Project (Intake Dam) was provided under Section 3109 of WRDA 2007, which became law on November 8, 2007 (P.L. 110-114). Section 3109 provides the Secretary of Army discretionary authority to assist the U.S. Bureau of Reclamation (Reclamation) with modification of the Lower Yellowstone Project for the purpose of ecosystem restoration utilizing funding from the MRRP. The Corps and Reclamation's Montana Area Office are serving as co-leads on the project.

A scope of work for the Intake Dam Environmental Impact Statement (EIS) was defined on August 8, 2008. The scope of work provided the structure to accommodate all activities being implemented to evaluate the Intake Dam. Each of these activities was identified and protocols were written directly into the scope of work. Roles and responsibilities for each of the co-leads were also written into the document.

The EIS was initiated with the publishing of the Notice of Intent to prepare an EIS in the Federal Register on September 12, 2008.

IV.C. Least Tern and Piping Plover Summary

IV.C.1. RPAs Applicable to Specific Species - Least Tern and Piping Plover

The BiOp states that "Habitat shall be provided as a priority and other management actions implemented to meet or exceed fledgling per pair ratio goals of 0.70 for least terns and 1.13 for piping plovers. These are to be determined as the recent (past) 3-year running average… These fledge ratios have been superceded (sic) by those found in the incidental take statement of this document." The BiOp incidental take statement fledge ratio for least terns is 0.94 fledglings per adult pair. The incidental take statement for piping plovers has six categories for incidental take. Only one of these categories, #5 - Take (harm) of eggs in nests assigned fates of destroyed-unknown, nest abandonment, sandbar erosion, and unknown fates, sets a system-wide fledge ratio. The USFWS noted that the 1993-2003 fledge ratio for piping plovers on the Missouri River system was 1.36 fledglings per adult pair. The USFWS quantified take for nests assigned fates of destroyed – no evidence, nest abandonment, sandbar erosion, and undetermined fates as being greater than 10% variance from that fledge ratio (1.22-1.47) for a 10-year weighted running average. The Corps, therefore, interprets the incidental take piping plover fledge ratio, as applied to habitat, to be the lower of the 10% variance from Category 5 – 1.22 fledglings per adult pair.

The Corps did not meet the fledge ratio goals for habitat for either species for the 3-year period ending in 2008. For the least terns, the 3-year running average fledge ratio for least terns for 2006-2008 was 0.83 fledglings per adult pair (1,974 fledglings/1,296 adult pairs), which is less than the recommended 0.94 fledglings per pair. The 3-year running average fledge ratio for piping plovers for 2006-2008 was 0.83 fledglings per adult pair (1,584 fledglings/1,918 adult pairs), which is less than the recommended 1.22 fledglings per pair.

IV.C.2. Missouri River Least Terns

IV.C.2.a. Incidental Take

IV.C.2.a.1. Take of Eggs and Chicks by Flooding on the River and Reservoir Reaches that Result from the Corps' Operations of the Missouri River Mainstem Reservoir System

The BiOp states that "reinitiation of consultation will be required if the Corps' actions will result in take of more than 180 eggs in a 3-year consecutive period." Table 2 shows the incidental take losses for the Missouri River for 2006-2008. The 3-year running total of 81 eggs and chicks for 2006-2008 was well below the 180 eggs (and chicks) trigger set forth in the BiOp.

Table 2. Incidental Take - Least Terns, 2006-2008

Year	Eggs	Chicks	Total
2006	16	2	18
2007	30	5	35
2008	32	0	32
3-Year Total	78	7	85

IV.C.2.a.2. Take of Eggs, Chicks, and Adults by Factors Influenced by, but not Directly Attributable, to the Corps

The BiOp states, "The Corps should reinitiate consultation if the running 5-year average fledge ratio is less than 0.94." In 2008, the 5-year average running fledge ratio (2004-2008) was 0.91 fledglings per adult pair (1,912 fledglings/2,109 adult pairs). The Corps did not meet this recommended incidental take measure for the second consecutive year. However, the 2004-2008 running 5-year fledge ratio of 0.91 represents a 0.01 increase over the 2003-2007 running 5-year fledge ratio. With the construction of additional habitat

through mechanical means and ongoing studies of vegetative management techniques that could provide more cost effective habitat creation in future years, the Corps is cautiously optimistic that the 5-year fledge ratio goal will be met in the future.

IV.C.2.b. Reasonable and Prudent Measures

RPM 1 – Survey and Monitor Least Terns, Mortality, and Incidental Take

RPM 1.1 – Summary Data

In 2008, adult census and productivity monitoring was conducted for least terns on the Missouri River. The adult census was 781. In 2008, 558 least tern nests and broods (551 nests and 7 broods) were found on the Missouri River. Of the 551 nests found, 317 nests were successful, for a nest success of 56.5%. In 2008, 382 least tern chicks fledged. The fledge ratio for 2008 was 0.98 fledglings per adult pair. Table 3 summarizes least tern adult census and productivity by segment in 2008.

Table 3. 2008 Adult Census and Productivity Monitoring of the Least Terns by Missouri River Segment

Segment	Adult Census	Nests	Broods	Nests Hatched	% Nest Success (a)	Number of Eggs	Chicks	Chicks Fledged	Fledge Ratio (b)
Fort Peck Lake	0	0	0	0	0	0	0	0	0
Fort Peck River	22	23	0	17	74	53	40	16	1.45
Lake Sakakawea	14	37	0	20	54	69	40	18	2.57
Garrison River	73	58	3	45	78	139	106	49	1.34
Lake Oahe	111	83	0	36	43	191	76	32	0.58
Lake Francis Case	0	0	0	0	0	0	0	0	0
Fort Randall River	58	36	1	23	64	84	60	33	1.14
Lewis and Clark Lake	225	158	0	70	44	400	169	75	0.67
Gavins Point River	278	156	3	107	69	395	278	159	1.14
Total	781	551	7	318	58	1,760	769	382	0.98

(a) % Nest Success = (NH/N)*100, where NH = nests hatched and N = number of nests. Broods are not included in the nest success calculation.

(b) Fledge Ratio = number of chicks fledged per pair of adult birds (adult census/2).

RPM 1.2 − Mortality

RPM 1.2.a – Nest Fates

In 2008, 551 least tern nests were found on the Missouri River. Of these nests, 318 were successful (at least one egg hatched from the nest). In addition to these successful nests, there were seven least tern broods that were found that could not be associated with any previously known nest (The nest was not found before the chicks hatched.). The apparent nest success was 57.7%. For the 233 non-successful nests, the nest losses are categorized below. In addition to the successful and non-successful nests, 109 nests had a fate that could not be determined (see Line 12 below).

1) Flooded (Non-Corps Operations) – 2 nests: These nests were lost to a rising lake level on Lewis and Clark Lake as a result of high tributary inflows from area storms. Releases from Fort Randall Dam were reduced during this time.

2) Flooded (Corps Operations) – 10 nests: These nests were lost due to the Corps' operation of the Missouri River dams.

3) Weather (Non-Corps Operations) – 17: These are nests lost to weather events such as rain, hail, wind, and wave action.

4) Weather (Corps Operations) – 5: These nests were lost to wave action as a result of the rising of Lake Oahe (2 nests) and increasing releases from Fort Randall Dam (3 nests).

5) Predation – 10: Predators include mink, raccoons, coyotes, owls, gulls, crows, and other mammal and avian species.

6) Livestock – 3: These nests were destroyed by livestock stepping on them.

7) Bank Erosion – 4: These nests were lost due to the river eroding away nest sites.

8) Wildlife – 0: There were no nests destroyed by wildlife.

9) Human Disturbance – 0: There were no nests lost to human activity.

10) Destroyed, No Evidence – 49: These were nests that were destroyed before the eggs could have hatched for which no cause could be determined by the survey crew.

11) Abandoned – 24: These are nests that were abandoned by the adults.

12) Fate Undetermined – 109: These are nests where the egg incubation was far enough along that the eggs could have hatched between site visits; however, the crew could find neither evidence of egg hatching nor evidence that the nest had been destroyed prior to the subsequent nest visit.

RPM 1.2.b – Adult and Chick Mortality

Survey crews were instructed to try to determine a cause of death for least tern adults and chicks found on site. If a cause of death could not be determined and the specimen was fresh (little to no decomposition), the specimen was then sent to the National Wildlife Health Center (NWHC) in Madison, Wisconsin for analysis. In 2008, the remains of 7 least tern adults, 5 fledglings, and 14 chicks were found by survey crews. The specimens are listed by segment and date.

1) Fort Peck River Segment (two adults, one chick)
July 28, 2008: One adult was collected off of a sandbar at RM 1689.7 and was sent to the NWHC for necropsy. Results from the NWHC are pending.
July 28, 2008: One chick, approximate age 17 days, was found on a sandbar at RM 1647.9. The specimen was too deteriorated for collection. The crew noted that thunderstorms and hail had occurred over the area in the previous week.
July 28, 2008: One adult was collected off of a sandbar at RM 1607.7 and was sent to the NWHC for necropsy. The necropsy determined that the adult died from the West Nile virus.

2) Lake Sakakawea Segment (three fledglings, two chicks)
July 21, 2008: One chick, about 2 days old, was found near a nest bowl on Shell Village Island. There were no obvious signs of a cause of death and it was too decomposed to send for necropsy.
July 21, 2008: One chick, about 12 days old, was found on Eight Pound Island in the Van Hook Arm. The chick was stiff with an eye missing and was too decomposed to send for necropsy.
August 4, 2008: Three fledglings were found on Shell Village Island. The fledglings appeared to have been dead for several days. There were no obvious signs of a cause of death, and the specimens were too decomposed to send for necropsy.

3) Fort Randall River Segment (one chick)
July 1, 2008: A 1- to 5- day-old chick was found dead on a sandbar at RM 866.5. The chick was too decomposed to determine a cause of death or be sent in for necropsy.

4) Lewis and Clark Lake Segment (one fledgling, three chicks)
July 17, 2008: One 11- to 15-day-old chick was found dead on the constructed sandbar at RM 826.6. The chick appeared fresh, but had a decaying odor. The specimen was left for the USGS research team.
July 21, 2008: One 1- to 5-day-old chick was found dead on a sandbar at RM 842.8. The chick was too decomposed to determine a cause of death or be sent in for necropsy.
July 22, 2008: One 6- to 10-day-old chick was found dead on the constructed sandbar at RM 826.6. The chick was too decomposed to determine a cause of death or be sent in for necropsy.
July 29, 2008: One fledgling was found dead on the constructed sandbar at RM 826.6. The fledgling's head was detached and lying near its body.

5) Gavins Point River Segment (five adults, one fledgling, seven chicks)
June 24, 2008: A 1-day-old chick was found in a nest bowl on a sandbar at RM 789.6. The crew reported that the chick appeared smashed but the nest bowl did not. The crew noted that it had rained the previous night.
July 2, 2008: Two 1-day-old chicks were found on the constructed sandbar at RM 791.5. The chicks were sent to the NWHC for necropsy. The lab reported the cause of death for one chick to be attributed to coliform infection and rupture of the yolk sac. The cause of death of the second chick was attributed to predation. Both chicks tested negative for the West Nile virus.
July 7, 2008: Feathers and a leg from an adult were found at the constructed sandbar at RM 770.0. The cause of death was believed to be predation.
July 8, 2008: One 6- to 10-day-old chick was found on the constructed sandbar at RM 777.7. The chick was partially decomposed with the skull exposed. The chick was too decomposed to determine a cause of death or be sent in for necropsy.
July 8, 2008: One 16- to 20-day-old chick was found on the constructed sandbar at RM 777.7. The chick was partially decomposed with the skull exposed. The chick was too decomposed to determine a cause of death or be sent in for necropsy.
July 9, 2008: A 1-day-old chick was found on the constructed sandbar at RM 755.0. The chick was sent to the NWHC for necropsy. A cause of death was not determined, but the chick tested negative for the West Nile virus.
July 14, 2008: One 21-day-old fledgling was found on the constructed sandbar at RM 777.7. The fledgling was sent to the NWHC for necropsy. The necropsy found the fledgling had a penetrating wound to the skull and fractures in the ribs and ileum. Cause of death was due to predation. The fledgling tested negative for the West Nile virus.
July 14, 2008: Feathers from an adult were found on the constructed sandbar at RM 777.7. Owl feathers were also found at the kill site. Predation was the likely cause of death.
July 23 2008: Feathers from an adult were found on a sandbar at RM 759.0. Owl feathers were also found at the kill site. Predation was the likely cause of death.
July 23 2008: Feathers from an adult were found on a sandbar at RM 758.9. Owl feathers were also found at the kill site. Predation was the likely cause of death.
July 28, 2008: A 1-day-old chick was found on the constructed sandbar at RM 770.2. The chick was too decomposed to determine a cause of death or be sent in for necropsy.
July 28, 2008: Feathers from an adult were found on the constructed sandbar at RM 777.7. Predation was the likely cause of death.

RPM 1.2.c – Measures Taken to Reduce Mortality

The Corps undertook several actions in 2008 to reduce mortality for least terns. These actions are discussed below.

Predator Trapping: During the 2008 nesting season Corps monitoring personnel and researchers for the USGS and Virginia Polytechnic Institute (VPI) noted losses of nests and chicks to predation on the Gavins Point River Segment.

To protect least tern and piping plover nesting sites on sandbars constructed on the Lewis and Clark Lake and Gavins Point River Segments, the Corps contracted with the U.S. Department of Agriculture Wildlife Services (USDA-WS) to trap Great Horned Owls (*Bubo virginianus*) during July 2008.

In 2007, constructed sandbars on the Gavins Point River Segment located at RM 770.0, 761.3, and 755.0 had shown significant losses of least tern and piping plover chicks that were attributed to predation, and a Great Horned Owl was captured at RM 770.0 in June 2007. For 2008, the Corps decided to be proactive and trap Great Horned Owls on these constructed sites and on the newly constructed sites.

USDA-WS personnel erected seven modified pole traps on the sandbar complex at RM 826.5 on Lewis and Clark Lake and two modified pole traps each on the six constructed sandbar complexes at RM 791.5, 777.7, 775.0, 770.0, 761.3, and 755.0 on the Missouri River. Traps were set on each Monday for 4 weeks (July 7, 14, 21, and 28) and were disabled each Friday (July 11, 18, and 25). The traps were removed on August 1, 2008. There was a total of 16 trapping days.

Five Great Horned Owls were trapped during the trapping period. This equals a trapping success of 1.6% based on 5 owls trapped divided by 19 modified pole traps times 16 trapping days. No owls were trapped on any of the seven traps set at RM 826.5 on Lewis and Clark Lake or at the two traps at RM 791.5. One owl each was trapped at RM 777.7, 775.0, 770.0, 761.3, and 755.0. The five owls were released at sites in Nebraska designated by the NGPC.

There was a loss of one non-targeted species during the 16 days of trapping. On July 16, 2008 at RM 770.0, an Eastern Kingbird (*Tyrannus tyrannus*) was found dead in a modified pole trap. The kingbird set off the trap when it landed on the pole. USDA-WS personnel readjusted the tension on the trap to avoid the taking of non-targeted species.

USGS researchers reported the loss of least tern chicks to minks (*Mustela mustela*) on the constructed sandbar complex at RM 826.5 on Lewis and Clark Lake during the 2008 breeding season. Because of this, and in conjunction with the owl trapping, USDA-WS personnel set 18 Conibear traps at various locations on the sandbar complex. The traps were set on July 8, 2008 and were removed on August 1, 2008. A total of zero (0) mink were captured during the trapping period.

Nest Moving and Raising: To prevent the loss of least tern nests to rising lake levels and increased releases from dams, nests were moved to a higher location, raised by building nest mounds, or both moved and raised. The results are shown in the Table 4. The results show that, after the action, nearly 40% of the nests were subsequently successful. Weather events resulted in the loss of one-third of the nests (6), two nests were lost to flooding, one was abandoned, and two had undetermined fates.

Table 4. Least Tern Nest Moving and Raising, 2008

Type	Nests	Success	% Successful	Flooded	Weather	Predation	Abandoned	Destroyed No Evidence	Undetermined Fate
Moved	8	2	25	2	3	0	0	1	0
Raised	9	4	44	0	3	0	1	1	0
Moved & Raised	1	1	100	0	0	0	0	0	0
Total	18	7	39	2	6	0	1	2	0

Chick Moving: On July 16, 2008, the Fort Randall crew was directed to check the sandbar at RM 842.8 in Lewis and Clark Lake to evaluate the effect of an increase in releases out of Fort Randall Dam. They found that much of the low areas had been inundated, but three high areas named NW Bar, NE Bar and SE Bar provided some elevation at the site. In addition to raising some of the nests (see above), the crew moved seven 6- to 10-day-old least tern chicks from a low area in between the three high points to the SE Bar. This was first attempt ever by a Corps crew to move least tern chicks on the Missouri River. After the move, the crew observed least tern adults going to the SE Bar. The RM 842.8 sandbar complex was observed from a distance on July 17, 2008 by Greg Pavelka and Gene Bormann. All seven relocated tern chicks were observed on the SE Bar and all were being attended by adults. On July 23, 2008, Pavelka and Bormann returned to the complex and observed zero least tern chicks on the SE Bar; however nine age-appropriate chicks were observed on the NW Bar. Of the nine, a maximum of four of the chicks could have hatched on this bar. This would mean at least five of the seven chicks from the SE Bar had moved to the NW Bar. On July 28, 2008 the Fort Randall crew reported ten fledglings on site, which would indicate that at least six of the seven relocated chicks had fledged.

RPM 1.3 – Annual Report

The Corps met the December 31 deadline in 2008 with a draft report.

RPM 2 – Monitor, Evaluate, and Adjust Operations to Minimize Take of Least Terns

RPM 2.1 – Monitoring of Least Tern Nests

The Corps had crews that visited as many sites as possible to determine the levels of the nests and the risk of flooding for dam release changes and rising lake levels in 2008. These data were available for discussions of water release and level changes in subsequent days and weeks.

RPM 2.2 – Water Management Coordination

Throughout the nesting season, representatives of the Corps' Missouri River Basin Water Management Division, Corps' Threatened & Endangered Species Section, and USFWS held conference calls almost every Monday, Wednesday, and Friday to discuss water releases from the Missouri River dams and their effects on least terns. These calls were used to discuss impending changes to water release schedules relative to nests and sandbars that have been identified as "at risk" due to Corps System operations, assess risk, and discuss alternatives to proposed actions. The calls provided timely information throughout the 2008 nesting season and helped to minimize incidental take by Corps System operations.

RPMs 2.3 and 2.4 – Assessment of Summer Release Method and Description of that Method to USFWS Staff

The Corps provided information to the public in its draft Annual Operation Plan (AOP) for the Missouri River Mainstem Reservoir System. After receiving public input on the information in the draft AOP, the Corps prepared its AOP, which was released in January 2008. Throughout the draft and final AOP processes, the release method, a steady release, flow-to-target operation for the summer of 2008 was discussed with USFWS staff.

RPM 3 – Designing, Constructing, and Managing Created Sandbars as Required by RPA IV.B.1

This RPM is discussed earlier in this Annual Report as part of the Emergent Sandbar Habitat Creation Activities.

RPM 4 – Monitor, Evaluate, and Modify Created and Rehabilitated Sandbars

RPM 4.1 – Created Sandbars

The Corps created sandbar complexes on the Gavins Point River Segment in 2004 at RM 755.0; in 2005 at RM 770.0 and RM 761.3; and in the fall of 2007/spring of 2008 at RM 791.5, RM 777.7, and RM 775.0. In the fall of 2006/spring of 2007 and the fall of 2007/spring of 2008 the Corps constructed a sandbar complex in Lewis and Clark Lake at RM 826.5.

Least terns used all seven constructed sandbar complexes in 2008. Tables 5 and 6 present the nest success on the constructed sandbars versus non-constructed sandbars on Lewis and Clark Lake and the Gavins Point River Segments. The tables show that, on the Lewis and Clark Lake and Gavins Point River Segments, the least terns overwhelming (86.1%) preferred to nest on the constructed sandbars compared to all other types of habitat. Nest success, however, was somewhat higher on the non-constructed habitat compared to the constructed habitat on both segments. This may be deceiving on Lewis and Clark Lake due to the extraordinarily high number of nests (40.6%) on the constructed sandbars where a nest fate could not be determined.

Table 5. Least Tern Nest Success on Constructed vs. Non-Constructed Sandbars – Lewis and Clark Lake Segment, 2008

Habitat Type	Total # of Nests	Successful	Not Successful	Not Determined	% Successful	% of Total Nests
Constructed	138	59	23	56	43	87
Non-Constructed	20	11	8	1	55	13
Total	158	70	41	57	44	100

Table 6. Least Tern Nest Success on Constructed vs. Non-Constructed Sandbars – Gavins Point River Segment, 2008

Habitat Type	Total # of Nests	Successful	Not Successful	Not Determined	% Successful	% of Total Nests
Constructed	135	92	30	13	68	85
Non-Constructed	24	18	5	1	75	15
Total	159	110	35	14	69	100

Tables 7 and 8 show the number of adults, percent of total adults, number of fledglings, percent of total fledglings, and fledge ratios for constructed versus non-constructed sandbars for the two segments. Table 7 shows that, on the Lewis and Clark Lake Segment, a majority of the adults and fledglings were on the constructed sandbars. However, the fledge ratio of 0.57 fledglings per adult pair was below the BiOp metric of 0.94. The low fledge ratio can be attributed to predation, primarily by minks. The non-constructed sandbars on the Lewis and Clark Lake Segment, Table 8, consisted of one sandbar complex at RM 842.8, a mile below the Niobrara/Missouri confluence. This site had a robust fledge ratio of 1.48. On the Gavins Point River Segment, the vast majority of the tern adults and fledglings were on the constructed sandbars as opposed to all other types of habitat on the river. The terns on the constructed sandbars were successful in their productivity with a fledge ratio of 1.27, which is well above the BiOp metric of 0.94. In contrast, the least terns that nested on non-constructed habitat had a poor fledge ratio of 0.60.

Table 7. Least Tern Adults, Fledglings, and Fledge Ratios on Constructed vs. Non-Constructed Sandbars – Lewis and Clark Lake Segment, 2008					
Habitat Type	Adults	% of Total Adults	Fledglings	% of Total Fledglings	Fledge Ratio
Constructed	202	90	58	77	0.57
Non-Constructed	23	10	17	23	1.48
Total	225	100	75	100	0.67

Table 8. Least Tern Adults, Fledglings, and Fledge Ratios on Constructed vs. Non-Constructed Sandbars – Gavins Point River Segment, 2008					
Habitat Type	Adults	% of Total Adults	Fledglings	% of Total Fledglings	Fledge Ratio
Constructed	225	81	143	90	1.27
Non-Constructed	53	19	16	10	0.6
Total	278	100	159	100	1.14

RPM 4.2 – Peer Review of Created and Rehabilitated Sandbars

The peer review has not yet been conducted even though the Corps completed its fourth year (2004, 2005, 2007, and 2008) of creating habitat. Relatively little habitat was created in the first 2 years, delaying the necessity of completing the peer review.

RPM 4.3 – Rehabilitated Sandbars

The Corps has done vegetation modification on existing sandbars on the Lake Oahe, Fort Randall River, Lewis and Clark Lake, and Gavins Point River Segments. Vegetation modification includes the herbicide spraying of vegetation or herbicide spraying followed by the mowing of the vegetation. Vegetation modification results are listed below by segment.

RPM 4.3.a – Lake Oahe Segment

Due to continued drought in the upper Missouri River Basin, Lake Oahe has been lowered to the point that a large part of the upper lake has returned to a riverine environment. Several of the exposed sandbars have become overgrown with vegetation. In the fall of 2006, three sandbars and one sandbar complex were sprayed with herbicide to eliminate the vegetation. Subsequently, the sandbars were mowed to cut down the dead vegetation in the spring of 2007. The sandbars that received treatment were RM 1293.0 (Rifle Range), RM 1286.2 (Silo), RM 1285.0 (Fire Island), and RM 1284.0 (Barrels). At the sandbar complex located at RM 1284.0 (Barrels), terns nested on parts of the sandbars that did not receive the herbicide spraying and mowing treatment. This habitat type is listed in the table below as spray and mow (nat). The riverine part of Lake Oahe in 2008 extended from RM 1304 down to RM 1263.5. In this section of the lake, the least terns nested on seven sandbars that did not receive any herbicide treatment and are considered to be not treated. The successes of the nesting on the sites in the upper reach of Lake Oahe are listed in Table 9. The table shows that the least terns made very little use of the spray and mow sandbars compared to the not treated sandbars. Also most of the use of spray and mow sandbars was on portions of the treated sandbars that did not receive any treatment.

Table 9 shows the nest success between the treated and not treated sandbars on this riverine part of Lake Oahe. Most of the least tern adults and fledglings were on the not treated sandbars compared to the spray

and mow sandbars. The fledge ratio on the not treated sandbars was above the BiOp metric of 0.94, while the fledge ratio on the spray and mow was below the BiOp metric.

Table 9. Least Tern Nest Success by Treatment Type – Upper Reach of the Lake Oahe Segment, 2008

Treatment Type	Total Nests	Successful Nests	Not Successful	Not Determined	% Successful	% of Total Nests
Not Treated	41	22	9	10	54	84
Spray and Mow	2	2	0	0	100	4
Spray and Mow (Nat)	6	3	2	1	50	12
Total	49	27	11	11	55	100

Table 10. Least Tern Productivity by Treatment Type – Upper Reach of the Lake Oahe Segment, 2008

Treatment Type	Adults	% of Total Adults	Fledglings	% of Total Fledglings	Fledge Ratio
Not Treated	38	88	25	96	1.32
Spray and Mow	5	12	1	4	0.4
Spray and Mow (Nat)*	0	0	0	0	0
Total	43	100	26	100	1.16

*Although there were six nests in spray and mow (nat) sites, all of the nests were initiated after the adult census and although three of the nests were successful, no chicks were known to have fledged.

RPM 4.3.b – Fort Randall River Segment

On this segment there have been two types of vegetation modification treatments: herbicide spraying only and herbicide spraying followed by mowing. The sandbars that have undergone vegetation modification are listed below by treatment type and year of treatment.

Sprayed, not Mowed: Sandbars at RM 866.9 and 866.5 were sprayed with herbicide in the fall of 2005. Dead plant material was not removed.
Spray 2005, Mow 2006: RM 870.2, RM 863.7 (part), RM 854.5, RM 854.0, RM 851.7 (part), RM 848.5, and RM 846.5
Spray 2005, Mow 2007: RM 869.5 (part)

At the sandbars located at RM 870.2 and 866.5, terns nested on parts of the sandbars that did not receive the herbicide spraying or the herbicide spraying and mowing treatment. These habitat types are listed in the table below as spray only (nat) and spray and mow (nat). There are sandbars that currently, or since 1998, have had least tern and/or piping plover nesting where no management activity such as spraying or spraying and mowing has occurred. These sites include sandbars at RM 875.0, RM 869.5 (part), RM 855.5, and RM 853.4. This habitat type is listed as not treated in Table 11. The table shows that a little less than 20% of the tern nests on the Fort Randall River Segment were on treated sites, a little more than 50% were on the natural areas of the treated sites and the remaining 30% were on sites that did not receive any vegetation modification treatment. It should be remembered that the herbicide spraying was done in 2005, and the mowing was done in 2006 and 2007. The effects of the treatment have, therefore, diminished over time as vegetation has re-emerged at the treated sites.

Table 11, Least Tern Nest Success by Treatment Type – Fort Randall River Segment, 2008						
Treatment Type	Total Nests	Successful Nests	Not Successful	Not Determined	% Successful	% of Total Nests
Spray Only	0	0	0	0	0	0
Spray and Mow	7	5	2	0	71	19
Spray Only (Nat)	15	11	3	1	73	41
Spray and Mow (Nat)	4	2	0	2	50	11
Not Treated	11	6	2	3	55	30
Total	37	24	7	6	65	100

Table 12 shows the productivity of the treatment types. The table shows that there were no fledglings at any of the treated sites. A major least tern colony was located on the west end of the non-treated part of the sandbar at RM 866.5. This colony produced a robust fledge ratio of 1.38, which exceeded the BiOp fledge ratio goal of 0.94. The least terns likewise did well on the sites that were not treated with an even higher fledge ratio of 1.57. This was the result of least terns using sandbars that normally are submerged during the nesting season but were exposed due to low releases from Fort Randall Dam that occurred during the breeding season.

Table 12. Least Tern Productivity by Treatment Type – Fort Randall River Segment, 2008					
Treatment Type	Adults	% of Total Adults	Fledglings	% of Total Fledglings	Fledge Ratio
Spray Only	0	0	0	0	0
Spray and Mow	12	21	0	0	0
Spray Only (Nat)	32	55	22	67	1.38
Spray and Mow (Nat)	0	0	0	0	0
Not Treated	14	24	11	33	1.57
Total	58	100	33	100	1.14

RPM 4.3.c – Lewis and Clark Lake Segment

On this segment, two types of vegetation modification treatments, herbicide spraying only and herbicide spraying followed by mowing have been used. The sandbars that have undergone vegetation modification are listed below by treatment type and year of treatment.

Sprayed: The sandbar at RM 839.5 was sprayed with herbicide in the fall of 2005, but the dead plant material was not removed.
Spray 2004, Mow 2006: RM 838.2
Spray 2005, Mow 2006: RM 839.0
Spray 2005, Mow 2007: RM 842.2, RM 838.0, and RM 837.0

There are sandbars that currently, or since 1998, have had least tern and/or piping plover nesting and where no management activity such as spraying or spraying and mowing has occurred. These sites include sandbars at RM 843.3, RM 842.6, RM 841.9, RM 840.0, RM 839.7, RM 838.6, RM 836.0, RM 835.0 RM 834.3, RM 832.2, RM 830.3, RM 828.4, and RM 827.0. This habitat type is listed as not treated in Table 13, which shows the nest success for the various habitat and treatment types. In this table, constructed

refers to the constructed sandbar complex at RM 826.5. Table 13 shows that least terns did not nest on the treated sites in 2008.

Table 13. Least Tern Nest Success by Treatment Type – Lewis and Clark Lake Segment, 2008

Treatment Type	Total	Successful	Not Successful	Not Determined	% Successful	% of Total
Spray Only	0	0	0	0	0	0
Spray and Mow	0	0	0	0	0	0
Not Treated	20	11	8	1	55	13
Constructed	138	59	23	56	43	87
Total	158	70	31	57	44	100

Table 14 shows the productivity for the treatment types. The table shows that there was no productivity for the treated sites in 2008 for the Lewis and Clark Lake Segment.

Table 14. Least Tern Productivity by Treatment Type – Lewis and Clark Lake Segment, 2008

Treatment Type	Adults	% of Total Adults	Fledglings	% of Total Fledglings	Fledge Ratio
Spray	0	0	0	0	0
Spray and Mow	0	0	0	0	0
Not Treated	23	10	17	23	1.48
Constructed	202	90	58	77	0.57
Total	225	100	75	100	0.67

RPM 4.3.d – Gavins Point River

On this segment two types of vegetation modification treatments, herbicide spraying only and herbicide spraying followed by mowing have been used. The sandbars that have undergone vegetation modification are listed below by treatment type and year of treatment.

Sprayed: Sandbars at RM 796.3, RM 768.0, and RM 759.5 were sprayed with herbicide in the fall of 2005, but the dead plant material was not removed.
Spray 2004, Mow 2005: RM 781.5
Spray 2004, Mow 2005 and 2006: RM 756.7
Spray 2004 and 2005, Mow 2007: RM 777.7
Spray 2005, Mow 2006: RM 801.1, RM 759.2, and RM 757.2
Spray 2005, Mow 2007: RM 799.0, RM 796.3, RM 795.3, RM 793.6, RM 793.3, RM 790.9, RM 789.6, RM 786.1, RM 785.2, RM 784.5, RM 783.0, RM 782.5, RM 778.5, and RM 773.0

At the sandbar located at RM 782.5, least terns nested on a part of the sandbar that did not receive the herbicide spraying and mowing treatment. This is listed in Table 15, which shows the nest success for the various habitat and treatment types for the Gavins Point River Reach, as spray and mow (nat). Sandbars that currently have, or since 1998 have had, least tern and/or piping plover nesting where no management activity such as spraying or spraying and mowing has occurred. These sites include sandbars at RM 808.2, RM 807.6 (shoreline), RM 807.4, RM 807.3, RM 804.6, RM 804.5, RM 803.4, RM 802.5, RM 801.3, RM 791.5, RM 788.5, RM 786.0, RM 779.2, RM 779.1, RM 779.0, RM 778.9, RM 777.5, RM 777.0, RM 776.4, RM 775.2, RM 764.5, and RM 760.0. This habitat type is listed as not treated in Table 14. The

constructed sandbars summarized in the table are at the following locations: RM 791.5, RM 777.7, RM 775.0, RM 770.2, RM 770.1, RM 770.0, RM 769.9, RM 761.3, and RM 755.0. The table shows that there was only one least tern nest on treated sites on the Gavins Point River Segment in 2008. The least terns greatly preferred the constructed sites to all other habitat sites. Because the herbicide spraying was done in 2004 and 2005 and the mowing was done at various locations in 2005, 2006, and 2007, the effects of the treatment have diminished over time as vegetation has re-emerged at the treated sites.

Table 15. Least Tern Nest Success by Treatment Type – Gavins Point River Segment, 2008

Treatment Type	Total	Successful	Not Successful	Not Determined	% Successful	% of Total Nests
Spray Only	0	0	0	0	0	0
Spray and Mow	1	1	0	0	100	1
Spray and Mow (Nat)	2	1	1	0	50	1
Not Treated	26	16	4	1	62	16
Constructed	135	92	30	13	68	85
Total	159	110	35	14	69	100

Table 16 shows the productivity for the treatment types for the Gavins Point River Segment. The table shows that the treated sites were little used by the tern adults, although one fledgling was produced for a fledge ratio of 0.50.

Table 16. Least Tern Productivity by Treatment Type – Gavins Point River Segment, 2008

Treatment Type	Adults	% of Total Adults	Fledglings	% of Total Fledglings	Fledge Ratio
Spray Only	0	0	0	0	0
Spray and Mow	4	1	1	1	0.5
Spray and Mow (Nat)	5	2	0	0	0
Not Treated	44	16	15	10	0.68
Constructed	225	81	143	90	1.27
Total	278	100	159	100	1.14

RPM 5 – Evaluate Effective Measures to Reduce Least Tern Predation

The Corps has not undertaken any efforts to date to address this RPM.

RPM 6 – Reduce Human Disturbance of Least Terns and Conduct Outreach and Education

RPM 6.1 – Human Restriction Measures

To deter human disturbance and increase awareness of endangered species, restriction signs and spacer stakes with orange twine were placed around least tern nesting sites. The signs, stakes, and twine created a "psychological barrier" that delineated the nesting sites for the public. Listed below are the sites where restrictions were posted.

Lake Sakakawea Segment: Restriction signs and no-off-road vehicle signs were placed at RM 1510.0 (Red Mike). Restriction signs were placed at RM 1455.8 (Eight Pound Island), RM 1429.0 (Indian Hills), and RM 1393.8 (Sportsman Centennial).

Garrison River Segment: Restriction signs were placed around nesting sites on the sandbars at RM 1319.9 (Heskett) and RM 1311.0 (Fort Lincoln).

Lake Oahe Segment: Restriction signs were placed around nesting sites at RM 1296.0 (Graner), RM 1233.0 (State Line), RM 1199.0 (Old Railroad Grade), and RM 1088.0 (Cow Creek Bay).

Fort Randall River Segment: Sandbars at RM 870.2, RM 866.5, RM 864.8, RM 863.7, and RM 854.7 were fenced and signed.

Lewis and Clark Lake Segment: The sandbar at RM 842.8 and the constructed islands at the RM 826.5 complex were posted with restriction signs and orange twine fencing.

Gavins Point River Segment: Restriction signs and orange twine fencing were placed around nesting sites on sandbars at RM 808.2, RM 807.3, RM 807.2, RM 804.6, RM 804.5, RM 795.3, RM 791.5, RM 788.5, RM 782.5, RM 777.7, RM 775.0, RM 770.2, RM 770.1, RM 770.0, RM 761.3, RM 756.6, and RM 755.0.

In a collaborative effort between the Corps; the USFWS; the NPS; and representatives of North Dakota, South Dakota and Nebraska wildlife protection agencies, the restriction signs posted on the sandbars were updated and redesigned. The updated signs were made state specific for Montana, North Dakota, South Dakota, South Dakota/Nebraska, and Kansas. The signs carried the appropriate Federal and state agencies logos and toll free numbers for citizens to report Endangered Species Act violations. The signs contain information on least terns and piping plovers and diagrams of prohibited acts.

Protection of least tern nesting sites was coordinated with law enforcement officers from the SDGFP and the USFWS. Conservation officers from the SDGFP conducted deterrence patrols throughout the nesting season on the Fort Randall River and Gavins Point River Segments. Special Agent Rich Grosz of the USFWS conducted surveillance on the Garrison River Segment, while Special Agent Brad Merrill of the USFWS conducted surveillance on Lewis and Clark Lake and the Gavins Point River Segments.

In 2008 there were no least tern nests lost due to human disturbance.

RPM 6.2 – Training of Personnel Interacting with Least Terns

Training sessions for personnel involved in least tern productivity monitoring were held at the Mobridge Office of the Oahe Project on May, 10, 2008, at the Gavins Point Project on May 22, 2008, and at the Riverdale Office of the Garrison Project on May 28, 2008. There were 32 attendees, including personnel from the Corps, the SDGFP, and the NPS. Training included sessions on the Endangered Species Act (ESA), least tern life history, ESA-permit conditions, monitoring techniques, census techniques, data input, and global positioning system (GPS) techniques.

RPM 6.3 – Monitoring of Activity at Sites with Least Terns

As described in RPM 6.1 above, Corps project lands on Lake Sakakawea, Lake Oahe, and Lewis and Clark Lake were posted with restriction signs to deter human disturbance of least tern nesting sites. These areas were also patrolled by Corps rangers and Corps bird-monitoring survey crews.

RPM 6.4 – Outreach and Education

In 2008, the Outreach Coordinator for the Omaha District Threatened & Endangered Species Section, Gene Bormann, gave presentations to one civic group, one university, and sixteen area schools in southeast South Dakota and northeast Nebraska. A total of 1,200 students were reached through this effort. Mr. Bormann also disseminated information about endangered species at the Wonders of Wildlife festival in Columbia,

Missouri. Other outreach efforts in 2008 at Corps projects included presentations for civic organizations, schools, environmental groups, campfire programs, and public interactions in the field; articles for area newspapers; and distribution of the "Missouri River Species at Risk" brochure to area businesses and the public.

IV.C.3. Kansas River Least Terns

IV.C.3.a. Incidental Take

One least tern nest containing two eggs was lost on the Kansas River in 2008 due to Corps operations. During a survey conducted on June 12, a least tern nest with two eggs was found at the Belvue site at RM 114.0. During June 18-22, releases were increased from Tuttle Creek Dam, and the water gage on the Big Blue River at Manhattan, Kansas, which is located below Tuttle Creek Dam, recorded average flows between 19,500 to 19,900 cfs. Previously on June 14, the gage recorded an average flow of 2,000 cfs. The Kansas River gage at Fort Riley, Kansas, located upriver from the Blue River confluence with the Kansas River recorded average flows between 9,400 and 9,700 cfs on June 18-22. The Kansas River gage at Belvue recorded average flows between 29,200 and 31,100 cfs on June 18-22. Corps releases out of Tuttle Creek Dam, therefore, contributed to the loss of the tern nest.

Three tern nests containing seven eggs were lost to flooding on the Kansas River in 2008, but these were not lost due to Corps operations. The three nests were also located at the Belvue site. These nests were found during a survey on June 4. On the next survey on June 12, the nests were recorded as lost due to flooding. Although releases out of Tuttle Creek Dam were increased on June 3-5, it is the opinion of the Corps' Kansas City District personnel that the nests were lost due to heavy tributary inflows from rain into the Kansas and not from the increased releases. On June 3, Corps releases out of Tuttle Creek Dam averaged about 500 cfs. On June 4, the average releases rose to 3,700 cfs, and on June 5, the releases averaged 4,300 cfs. On June 6 releases averaged 200 cfs. The Kansas River gage at Fort Riley recorded average flows of 5,300 cfs on June 4, 5,400 cfs on June 5, 6,200 cfs on June 6, and 5,400 cfs on June 7. The Kansas River gage at Belvue recorded average flows of 5,500 cfs on June 4, 11,200 cfs on June 5, 21,900 cfs on June 6, and 10,600 cfs on June 7. The nests were probably lost on June 6 when the Belvue gage averaged 21,900 cfs with the increase from Tuttle Creek Dam on June 4-5 not being a factor in the loss.

IV.C.3.b. Reasonable and Prudent Measures

RPM 1 – Survey and Monitor Least Terns, Mortality, and Incidental Take

RPM 1.1 – Summary Data

In 2008, an adult census and productivity monitoring was conducted for least terns on the Kansas River. The adult census for least terns was zero; however, four least tern nests containing nine eggs were found on the Kansas River. Of the four nests found, none were successful, for a nest success of 0.0%.

RPM 1.2 – Mortality

RPM 1.2.a – Nest Fates

All four of the nests were lost to flooding.

RPM 1.2.b – Adult and Chick Mortality

Survey personnel did not find any dead adults or chicks in 2008.

RPM 1.2.c – Measures Taken to Reduce Mortality

There were no activities undertaken to reduce mortality.

RPM 2 – Monitor, Evaluate, and Adjust Operations to Minimize Take of Least Terns

RPM 2.2 – Water Management Coordination

Throughout the nesting season, representatives of the Corps' Kansas City District participated in the conference calls held between the Corps' Missouri River Basin Water Management Division, Threatened & Endangered Species Section, and the USFWS. During these calls the Kansas City District personnel updated the situation on how Corps operations on Kansas River tributaries could affect least tern nesting on the Kansas River.

IV.C.4. Missouri River Piping Plovers

IV.C.4.a. Incidental Take

The USFWS, listed six categories in the BiOp where incidental take for piping plovers could be expected to occur. Listed below are the six incidental take categories and the results for 2008.

1. Take (killing) of eggs and chicks by flooding on the river and reservoir reaches that result from the Corps' operation of the water control system

In the BiOp, the USFWS set two standards of incidental take in regard to Corps operations:

a. Incidental take due to flooding resulting from Corps operations is expected to be 8.4% of all eggs, which represents the amount of incidental take of eggs that occurred due to Corps operations from 1993 to 2003. Computation of the incidental take is to be done on a 10-year running average basis. Actual incidental take by flooding is expected to vary by 10% from this value, which results in a lower expected limit of 7.6% and an upper limit of 9.2%.

b. Take is also not expected to exceed that observed in any single year in the period from 1993 to 2003. This has been quantified as the lesser of 294 eggs (1995) or 46% of all eggs (1996).

In 2008, 263 eggs and chicks (256 eggs and 7 chicks) were lost due to Corps operations. This represents 10.4% of the 2,526 known piping plover eggs on the Missouri River in 2008. This is below both standards set forth in the BiOp. The 10-year average of plover eggs lost due to Corps operations during the last 10 years, 1999-2008, was 4.8% (1,106/23,015). This is even below the 7.6% lower limit of expected losses set by the USFWS in the BiOp.

2. Take (harm) of eggs, chick, or adults by predation

In the BiOp, the USFWS noted that 4.0% of monitored nests were lost to predation from 1993 to 2003. The USFWS expected take could vary by 10% outside of that 4.0% loss and set expected loss from predation as being from 3.6% to 4.4%, to be computed as a 10-year running average. In 2008, 18 of 661 plover nests were lost to predation for a loss rate of 2.7%. The 10-year average for the 1999-2008 period, was 4.4% (279/6,334), which is at the upper limit of the 3.6% to 4.4% expected loss range set forth in the BiOp.

3. Take (harm) of eggs, chicks, or adults by human disturbance

In the BiOp, the USFWS consider take from human disturbance only from the riverine segments. The USFWS noted that 1.5% of monitored nests on the riverine segments were lost to human disturbance from 1993 to 2003. The USFWS expected take could be quantified as being within 10% of that 1.5% loss and set expected loss from human disturbance as being from 1.4% to 1.7% as a 10-year running average. In 2008, 1 of 300 plover nests on the riverine segments was lost due to human disturbance for a loss rate of 0.3%. The 10-year average for the 1999-2008 10-year period was 1.2% (34/2,800), which is below the 1.4% to 1.7% expected range set forth in the BiOp.

4. Take (harm) of chicks as a result of insufficient forage in river reaches affected by hypolimnetic releases

In the BiOp, the USFWS noted that hypolimnetic hydropower releases from Fort Peck, Garrison, and Fort Randall Dams would continue to provide unsuitable water temperatures for piping plover chicks below these dams and negatively impact production at all trophic levels, which would result in the taking of these chicks. The USFWS quantified this take in the form of expected fledge ratios for these three segments, with a variance of not to exceed by more than 10% the fledge ratios on these segments for 1993-2003 period. The 1993-2003 fledge ratio below Fort Peck Dam was 1.33 (1.20 to 1.46 variance), Garrison Dam 1.18 (1.06 to 1.30 variance), and Fort Randall Dam 0.92 (0.83 to 1.01 variance).

The USFWS made no mention of a running average for these fledge ratios, but since 10-year running averages were used for the other five measures of take, the Corps interprets that this was an omission on the part of the USFWS and have included the 10-year 1999-2008 average along with the 2008 fledge ratios.

For the Fort Peck River Segment, the 2008 fledge ratio was 0.00, while the 10-year average for the 1999-2008 period was 1.11 (15 fledglings/13.5 adult pairs). This is below the 1.20 lower limit fledge ratio set forth in the BiOp.

For the Garrison River Segment, the 2008 fledge ratio was 1.37, while the 10-year average for the 1999-2008 period was 1.21 (1005 fledglings/833 adult pairs). This is within the expected 1.18 to 1.30 fledge ratio range set forth in the BiOp.

For the Fort Randall River Segment, the 2008 fledge ratio was 1.00, while the 10-year average for the 1999-2008 period was 0.83 (164 fledglings/197.5 adult pairs). This is at the lower limit of the 0.83-1.01 the expected fledge ratio range set forth in the BiOp.

5. Take (harm) of eggs in nests assigned fates of destroyed-unknown, nest abandonment, sandbar erosion, and unknown fates

The USFWS, in the BiOp, noted that the 1993 to 2003 average fledge ratio for piping plovers on the Missouri River system was 1.36 fledglings per adult pair. The USFWS quantified take for nests assigned fates of destroyed – no evidence, nest abandonment, sandbar erosion, and undetermined fates – as being within the 10% range from that fledge ratio (1.22 to 1.47) on a 10-year running average basis. The 10-year average for the last 10 years, 1999-2008, was 1.25 (7,518 fledglings/6,006 adult pairs), which is within the 10% range set by the USFWS in the BiOp.

6. Take (harm) of chicks as a result of insufficient forage on created habitats

In the BiOp, the USFWS noted that piping plover chicks may starve on created habitats due to insufficient forage. The USFWS anticipated that fledge ratios in the created habitats would approximate those for observed from 1993 to 2003 – 1.36 fledglings per pair. The USFWS, in the BiOp, expected that there may be a variance of as much as 10% from the 1.36 fledge ratio and, therefore, set a range of 1.22 to 1.47 for the fledge ratio, to be based on a 10-year running average for take compliance. The Corps habitat creation efforts in the early 1990s were destroyed by high releases from Garrison, Fort Randall and Gavins Point Dams in 1995, 1996, and 1997. Habitat has been created at six sites on the Gavins Point River Segment at RM 755.0 in 2004; RM 770.0 and 761.3 in 2004-2005; and RM 791.5, RM 777.7, and RM 775.0 in 2007-2008. On Lewis and Clark Lake, habitat was created at RM 826.5 in 2006-2008. The fledge ratio for these created habitat sites is, therefore, based on the past 5 years of habitat creation (2004-2008) and not the 10-year average. For 2004-2008, the fledge ratio for created habitat was 1.41 fledglings per adult pair (496 fledglings/352 adult pairs) which is within the 1.22-1.47 fledge ratio range set forth in the BiOp.

IV.C.4.b. Reasonable and Prudent Measures

RPM 1 – Survey and Monitor all Plover Sites on the Missouri and Kansas Rivers

RPM 1.1 – Summary Data

In 2008, an adult census and productivity monitoring were conducted for piping plovers on the Missouri River. The adult census was 1,274. In 2008, 729 piping plover nests and broods (661 nests and 68 broods) were found on the Missouri River. Of the 661 nests found, 373 nests were successful, for an apparent nest success of 56.4%. In 2008, 675 piping plover chicks fledged. The fledge ratio for 2008 was 1.06 fledglings per adult pair. Table 17 summarizes piping plover adult census and productivity by segment in 2008.

Table 17. 2008 Adult Census and Productivity Monitoring of the Piping Plover on the Missouri River, 2008

Segment	Adult Census	Nests	Broods	Nests Hatched	% Nest Success) (a)	Number of Eggs	Chicks	Chicks Fledged	Fledge Ratio (b)
Fort Peck Lake	9	2	1	0	0	10	2	1	0.22
Fort Peck River	0	0	0	0	0	0	0	0	0
Lake Sakakawea	363	139	38	58	42	584	300	124	0.68
Garrison River	218	104	16	75	72	402	303	149	1.37
Lake Oahe	281	175	6	92	53	643	335	127	0.9
Lake Francis Case	0	0	0	0	0	0	0	0	0
Fort Randall River	26	15	1	8	53	61	31	13	1
Lewis and Clark Lake	57	45	10	22	44	161	79	39	1.37
Gavins Point River	320	181	6	118	65	665	452	222	1.39
Total	1,274	661	68	373	56	2,526	1,502	675	1.06

(a) % Nest Success = (NH/N)*100, where NH = nests hatched and N = number of nests

(b) Fledge Ratio = number of fledged chicks per pair of adult birds

RPM 1.2 – Survival and Take Information

The fledge ratio for the Missouri River in 2008 was 1.06 fledglings per adult pair. Table 17 shows a segment-by-segment breakdown of fledge ratios.

The USFWS, in this measure, requests a "quantification of take, including loss of eggs, chicks, adults, and habitat that occurred … along with the reasons or causes for take and any actions the Corps may have taken to avoid take." In 2008, there was a take of at least 5 adults, 1,024 eggs (2,526 eggs – 1,502 chicks) and 827 chicks (1,502 chicks – 675 fledglings). Take of chicks and eggs occurred from a variety of events. Nest loss causes are listed in the next section. Determining the cause of take for chicks is difficult because, generally, there is very little evidence. In 2008, survey crews found the remains of just six chicks. Actions taken by the Corps to avoid take include management of water releases from the dams to minimize flood events, use of predator cages to protect nests, placement of restriction signs around nesting and brooding areas to avoid human disturbance, the raising and moving of nests to avoid inundation, and the moving of chicks to avoid inundation.

Habitat losses have not been quantified at the time this report was written, but habitat was lost due to erosion, the rising of the reservoirs that eliminated beach habitat, and vegetation encroachment on the shoreline beaches and sandbars.

RPM 1.3 – Nest and Egg Losses

RPM 1.3.a – Nest Fates

In 2008, 661 piping plover nests were found on the Missouri River. Of these, 373 were successful (at least one egg hatched from the nest). In addition to these successful nests, there were 68 plover broods that were found that could not be associated with any previously known nest. The apparent nest success was 56.4%. For the 288 non-successful nests, the nest losses are categorized below. Included in the list of nest losses is an estimate of egg losses as per RPM 1.3 on page 252 of the BiOp. RPM 1.3 states, "Methods of analysis that accurately (e)stimate the number of eggs in destroyed nests at the time of their destruction shall be used. For example, a nest is visited during the laying period before a full modal clutch size of four (Haig 1992) had been laid. On the next visit, seven days later, the nest has been destroyed. The estimate should be based on the number of eggs observed plus an assumption that the following eggs were laid at a rate of 1 egg per 1.5 days."

1) Flooded (Non-Corps Operations) – 3 nests (10 eggs known, 12 eggs maximum): These nests were lost to rising river levels as a result of rain storms in the area.

2) Flooded (Corps Operations) – 71 nests (240 eggs known, 268 maximum): These nests were lost due to the Corps' operation of the Missouri River Mainstem Reservoir System.

3) Weather (Non-Corps Operations) – 44 nests (148 eggs known, 164 eggs maximum): These were nests lost to weather events such as rain, hail, wave action, and wind.

4) Weather (Corps Operations) – 3 nests (12 eggs known, 12 maximum): These nests were lost to wave action as a result of Corps operations involving Fort Peck Lake, Lake Sakakawea, and Lake Oahe.

5) Predation – 18 nests (63 eggs known, 64 eggs maximum): Predators include mink, raccoons, coyotes, owls, gulls, crows, and other mammal and avian species.

6) Livestock – 0 nests (0 eggs known, 0 eggs maximum)

7) Bank Erosion – 1 nest (1egg known, 4 eggs maximum): This nest was lost due to the river eroding away the nest site.

8) Wildlife – 0 nests (0 eggs known, 0 eggs maximum).

9) Human Disturbance – 5 nests (12 eggs known, 13 eggs maximum): These nests were lost to human activity.

10) Researcher – 1 nest (4 eggs known, 4 eggs maximum): This nest was accidentally destroyed by a researcher

11) Destroyed, No Evidence – 69 nests (201 eggs known, 253 eggs maximum): These were nests that were destroyed before the eggs could have hatched, but for which no cause could be determined by the survey crew.

12) Abandoned – 21 nests (65 eggs known, 65 eggs maximum): These were nests that were abandoned by the adults.

13) Fate Undetermined – 52 nests (190 eggs known, 190 eggs maximum): These are nests where the egg incubation was far enough along that the eggs could have hatched between site visits. However, the crew could find neither evidence of egg hatching nor evidence that the nest had been destroyed prior to the subsequent nest visit. In this category the incubation stage was far enough along whereby the eggs could

have hatched between site visits. Therefore, the clutch was complete and no more eggs would have been laid between site visits.

RPM 1.4 – Habitat Mapping

The Corps contracted with the USGS-NPWRC to develop and evaluate methods to inventory, monitor, and estimate least tern and piping plover habitats using Quickbird imagery. In 2008, Quickbird imagery was captured for the Fort Peck River, Garrison River, Upper Lake Oahe, Fort Randall River, Upper Lewis and Clark Lake, and the Gavins Point River Segments.

RPM 2 – Documenting Take of Piping Plovers

RPM 2.1 – Incidental Take

The USFWS requires that the Corps document take that occurs due to operation of the System. In 2008, Corps operations were responsible for the loss of 256 piping plover eggs from 75 nests and 7 piping plover chicks for a total loss of 263 eggs and chicks. The losses came as a result of six events. The events are listed in chronological order; however, it should be noted that the losses on Lake Sakakawea and Lake Oahe occurred over an extended period of time.

***1. May – August 2008 Lake Sakakawea Rise*:** Lake Sakakawea is operated to rise from May through July to capture snow pack runoff from the Northern Rockies, primarily from the Yellowstone River Basin. At the time of the first piping plover nest initiation on May 4, 2008, the level of Lake Sakakawea was at 1807.4 feet msl. Due to lower-than-normal releases out of Garrison Dam, Lake Sakakawea did not peak until August 13, 2008 when it reached 1826.0 ft msl. During the nesting season the lake rose 18.6 feet. A total of 58 piping plover nests with 194 eggs were inundated by the rise of the lake or were lost to wave action as the lake rose. In addition, six piping plover chicks were lost when the islands they were on were inundated by the rising lake.

***2. May – July 2008 Lake Oahe Rise*:** Lake Oahe is operated to have a stable to declining lake level during the spring and summer. However, heavy precipitation events and very low releases out of Oahe Dam caused the lake to rise throughout the nesting season. At the time of the first piping plover nest initiation on May 1, 2008, Lake Oahe was at 1582.8 ft msl. The lake continued to rise, peaking at 1594.3 ft on July 19, 2008 – a gain of 11.5 feet. A total of 13 piping plover nests containing 50 eggs were inundated by the rising of the lake.

***3. June 2008 Increased Releases out of Garrison Dam*:** Nest 084020, a one-egg nest with zero days incubation was found on a sandbar at RM 1377.0 on June 15, 2008. The nest was gone with flood debris around the nest bowl when the site was next surveyed on July 3, 2008. Releases out of Garrison Dam were 14,100 cfs on June 15, and the peak reading on the Stanton gage, located 4 miles downriver from the nest was 9.14 ft. The highest gage reading between June 15 and July 3 was 9.79 feet on June 18. On that date, releases out of Garrison Dam were increased to 14,700 cfs. There was no precipitation recorded at Garrison Dam on June 18, and there are no major tributaries between the dam and the nest site. The increased releases out of Garrison Dam caused the loss of the nest.

***4. June 2008 Survey Crew at Lake Sakakawea*:** On June 25, 2008, Nest 083056, a four-egg plover nest on Shell Village Island, was accidentally stepped on and destroyed by a Corps survey crew member.

***5. July 2008 Fort Peck Lake Rise*:** Fort Peck Lake is operated to capture snow pack runoff from the Rocky Mountains in the watershed above the dam. At the time of the first piping plover nest initiation on May 4, 2008, the lake level of Fort Peck Lake was at 2198.8 feet msl. The lake peaked on July 21, 2008 at 2210.1 ft msl, a gain of 11.3 feet. One nest with four eggs was lost due to inundation, and one nest with four eggs was lost due to wave action as the lake rose.

***6. July 2008 Navigation Support*:** Nest 089197 had three eggs and 10 days of incubation on July 16, 2008, when the nest was raised by the Fort Randall crew. On the next visit on July 21, the eggs were

missing and there was flood debris around the nest bowl. On July 16, releases out of Fort Randall Dam averaged 16,500 cfs. On July 18, releases were increased to support navigation in the lower river. For July 18-21, releases varied from 17,600 – 17,900 cfs. The increase in releases contributed to the loss of the three-egg nest.

***7. July 2008 Survey Crew at Gavins Point River*:** A 1-day-old chick on a sandbar at RM 795.3 was crushed by a stick when the stick was stepped on by a member of the Gavins Point survey crew.

RPM 2.2 – Adult and Chick Mortality

As per RPM 2.2, survey crews were instructed to try and determine a cause of death for piping plover adults and chicks found on site. If a cause of death could not be determined and the specimen was fresh (little to no decomposition), the specimen was then sent to the NWHC in Madison, Wisconsin for analysis.

In 2008, the remains of five piping plover adults, and six chicks were found by survey crews. The specimens are listed by segment and date.

1) Lake Sakakawea Segment (1 adult and 1 chick)
June 19, 2008: A recently deceased adult was found at Elbowwoods Bay. The adult was sent to the NWHC for necropsy.
July 16, 2008: A nearly fledged chick was found on Mallard Island. The chick appeared to have died several days earlier. There were no obvious signs of a cause of death, and it was too decomposed to send for necropsy.

2) Lake Oahe Segment (3 adults)
June 6, 2008: Three adults were found dead near nest bowls at Cow Creek Bay. The deaths were attributed to a hail storm that struck the area on June 2, 2008.

3) Lewis and Clark Lake Segment (3 chicks)
July 21, 2008: Two 1- to 5-day-old chicks were found in late stage decomposition on a sandbar at RM 842.8. A cause of death could not be determined.
July 22, 2008: One 6- to 10-day-old chick was found in late stage decomposition at the constructed sandbar at RM 826.6. A cause of death could not be determined.

4) Gavins Point River Segment (1 adult, 2 chicks)
June 26, 2008: On the sandbar at RM 795.3, a 1-day-old chick associated with Nest 0810079 was crushed by a stick after the stick was stepped on by a member of the Gavins Point survey crew.
July 14, 2008: A large quantity of feathers and a part of a leg of an adult was found on the constructed sandbar at RM 770.0. Predation is believed the cause of the take.
July 17, 2008: One chick, approximately 8 days old, was found on a sandbar at RM 795.4. The crew believed the chick had been stepped on by an unknown person.

RPM 3 – Coordinating Operations to Minimize Take

Throughout the nesting season, representatives of the Corps' Missouri River Basin Water Management Division, Corps' Threatened & Endangered Species Section, and USFWS held conference calls almost every Monday, Wednesday, and Friday to discuss water releases from the Missouri River dams and their effects on piping plovers. These calls were used to discuss impending changes to water release schedules relative to nests and sandbars that have been identified as "at risk" due to Corps System operations, assess risk, and discuss alternatives to proposed actions. The calls provided timely information throughout the 2008 nesting season and helped to minimize incidental take by Corps System operations.

RPM 4 – Moving Eggs to Higher Elevations to Avoid Flooding

Moving Nests: In 2008, 27 plover nests were moved to a higher location to avoid loss by flooding, 15 nests were raised in place to provide a higher elevation, and 1 nest was both moved and raised. Table 18

below shows the results of these three actions. The three management actions resulted in a little more than a third of the nests from which chicks successfully hatched. Moving nests was the preferred method on Lake Sakakawea and Lake Oahe as the lakes rose during the nesting season. Nest success was poor with a little more than a quarter of the nests being successful. The primary cause of loss was flooding, with a third of the moved nests eventually being inundated by the rising lake levels. All but one of the raised nests occurred on the Fort Randall River, Lewis and Clark Lake, and Gavins Point River Segments. Nest raising was done primarily in response to increased releases out of the dams. Nest success for this method was good with nearly half of the nests being successful.

Table 18. Piping Plover Nest Moving and Raising, 2008

Type	Nests	Success	% Successful	Flooded	Weather	Predation	Abandoned	Destroyed No Evidence	Undetermined Fate
Moved	27	7	26	9	1	4	1	0	5
Raised	15	7	47	2	1	0	2	2	1
Moved & Raised	1	1	100	0	0	0	0	0	0
Total	43	15	35	11	2	4	3	2	6

Moving Chicks: Piping plover chicks were moved from islands and sandbars that faced likely inundation to sites with higher elevation. The results are listed below by segment and date.

1) Lake Sakakawea Segment: With the rising of the lake level during the 2008 breeding season, three plover broods were moved from islands in danger of inundation to sites with higher elevations. The list below summarizes the moving activities.

Islands off Mallard Island: These are a group of islands to the northeast of Mallard Island. On June 24, 2008, two 1- to 5-day-old piping plover chicks were moved from their natal island to a larger, nearby island to prevent their loss from the rising lake level. The two were observed fledged on July 16, with identification confirmed by the bands placed on the chicks after they hatched by the USGS research team.

Arikara Island: A brood of two 16- to 20-day-old chicks were moved from the island to the shoreline of Arikara Bay on July 2, 2008. When the crew returned on July 9, the chicks were not seen. The chicks would have been around 25 days old on July 9, so it is possible that they had fledged and left the area.

Seven Sisters: The Seven Sisters is a small group of islands located between Mallard Island to the south and the north shore of the lake. On July 3, 2008, two 11- to 15-day-old chicks were moved from Seven Sisters NE Island (RM 1397.4) to Steinke Island. The chicks were not seen on subsequent surveys of Steinke Island.

2) Lewis and Clark Lake Segment: Increased releases out of Fort Randall Dam in mid-July 2008 inundated most of a sandbar complex at RM 842.8, leaving just three small sandbars designated NW Bar, NE Bar, and SE Bar and some low areas. On July 17, 2008, Greg Pavelka and Gene Bormann viewed the site from a distance using binoculars. They noted that Nest 099188, which had been raised by the Fort Randall crew, was completely surrounded by water. They observed an adult and two newly hatched chicks on the raised nest mound.

The two returned on July 18 to evaluate the situation, and they decided to move the chicks from the raised mound to the NW Bar. Three 1-day-old chicks were found on the raised mound and moved. With a forecast of higher releases out of Fort Randall Dam, it was decided to also move a brood of four 11- to 15-day-old chicks that were found on a mud flat between the NW, NE, and SE Bars to the NW Bar. The Fort Randall crew surveyed the sandbar on July 21 and observed four 6- to 10-day-old chicks and eight 11- to 15-day-old chicks on site. They also found two dead 1- to 5-day-old plover chicks that were too

decomposed to collect for necropsy. It is not known if the two dead chicks were from Nest 099188 or from other piping plover broods at the complex. The four 11- to 15-day-old chicks that had been moved most likely were part of the eight 11- to 15-day–old chicks that were observed, as the maximum number of chicks in that age group for that date was eight (Nests 099191 & 099193).

On July 23, 2008, Pavelka and Bormann returned to the sandbar complex to evaluate the situation. The bars were observed from a distance using binoculars. The two observed four 6- to 10-day-old and four 16- to 20-day-old chicks on the NW Bar. The Fort Randall crew returned on July 28 to survey the sandbar complex and found no chicks or adults on site. None of the moved chicks were known to have fledged.

3) Gavins Point River Segment: Increased releases out of Gavins Point Dam in August 2008 had greatly reduced the size of a small sandbar at RM 774.0 that contained a brood of three chicks. With a forecast of increased releases, it was decided on August 11, 2008 to move the three 11- to 15-day-old chicks a mile upriver to the constructed sandbar at RM 775.0. The chicks were placed on the northern side of the largest of the three sandbars in the complex. Chicks of the appropriate age of the transplanted chicks were not seen on subsequent surveys, and it is presumed that the three chicks did not fledge.

RPM 5 – Reduce Human Disturbance of Piping Plovers and Conduct Outreach and Education

RPM 5.1 – Public Service Announcements and Video

Public Service Announcements on behalf of piping plovers on the Missouri River were not done in 2008.

RPM 5.2 – Outreach Efforts

The Outreach Coordinator for the Omaha District Threatened & Endangered Species Section, Gene Bormann, gave presentations to one civic group, one university, and sixteen area schools in southeast South Dakota and northeast Nebraska. A total of 1,200 students were reached through this effort. Mr. Bormann also disseminated information about endangered species at the Wonders of Wildlife festival in Columbia, Missouri. Other outreach efforts in 2008 at Corps projects included presentations for civic organizations, schools, environmental groups, campfire programs, and talks to the public in the field; articles for area newspapers; and distribution of the "Missouri River Species at Risk" brochure to area businesses and the public.

RPM 5.3 – Human Restriction Measures

To deter human disturbance and increase awareness of endangered species, restriction signs and spacer stakes with orange twine were placed around piping plover nesting sites. The signs, stakes, and twine created a "psychological barrier" that delineated the nesting sites for the public. Listed below are the sites where restrictions were posted.

1) Lake Sakakawea Segment: Restriction signs and no-off-road-vehicle signs were placed at RM 1510.0 (Red Mike). Restriction signs were placed at RM 1455.8 (Eight Pound Island), RM 1429.0 (Indian Hills), and RM 1393.8 (Sportsman Centennial).

2) Garrison River Segment: Restriction signs were placed around nesting sites on the sandbars at RM 1319.9 (Heskett) and at RM 1311.0 (Fort Lincoln).

3) Lake Oahe Segment: Restriction signs were placed around nesting sites at RM 1296.0 (Graner), RM 1233.0 (State Line), RM 1199.0 (Old Railroad Grade), RM 1088.0 (Cow Creek Bay), and RM 1083.1 and RM 1083.0 (Peoria Flats).

4) Fort Randall River Segment: Sandbars at RM 870.2, RM 866.5, RM 864.8, RM 863.7, RM 854.7, RM 854.0, RM 851.9, and RM 851.7 were fenced and signed.

5) Lewis and Clark Lake Segment: The sandbar at RM 842.8 and the created islands at the RM 826.5 complex were posted with restriction signs and orange twine fencing.

6) Gavins Point River Segment: Restriction signs and orange twine fencing were placed around nesting sites on sandbars at RM 808.2, RM 807.3, RM 807.2, RM 804.6, RM 804.5, RM 795.3, RM 791.5 , RM 788.5, RM 782.5, RM 777.7, RM 775.0, RM 770.2, RM 770.1, RM 770.0, RM 761.3, RM 756.6, and RM 755.0.

Protection of piping plover nesting sites was coordinated with law enforcement officers from the SDGFP and the USFWS. Conservation officers from the SDGFP conducted deterrence patrols throughout the nesting season on the Fort Randall River and Gavins Point River Segments. Special Agent Rich Grosz of the USFWS conducted surveillance on the Garrison River Segment, and Special Agent Brad Merrill of the USFWS conducted surveillance on Lewis and Clark Lake and the Gavins Point River Segments.

RPM 6 – Predator Management

RPM 6.1 – Predator Trapping

In 2008, the Corps contracted with the USDA to trap Great Horned Owls on sandbars used by piping plovers at one location on the Lewis and Clark Lake Segment and six locations on the Gavins Point River Segment. A summary of the trapping effort can be found under the least tern RPM 1.2c.

RPM 6.2 − Predator Exclosures

Wire-mesh cages were used in 2008 to protect piping plover nests from mammalian and avian predators. The cages consist of 3-foot by 3-foot by 1-foot wire mesh containing 2-inch by 4-inch openings. The cages are placed over the piping plover nest and anchored into the substrate with metal stakes at the four corners. After placing the cage, the surveyors retreat and watch the cage to ensure that the piping plover returns to the nest inside the cage. If the piping plover refuses to enter the cage, the cage is removed. When a nest is terminated the cage is removed.

As a general rule, cages were placed over piping plover nests located on riverine segments; however, for nests on the reservoirs, judgment of the crew is used to determine whether or not to place cages. The rationale for not placing cages over nests on reservoirs is that most piping plover nests on reservoirs are in remote, spread-out locations and may not be subject to predator pressure. Table 19 shows by segment data on this effort. In 2008, 54% (358/661) of all piping plover nests were caged. Overall, nest success was far higher for caged piping plover nests at 71% compared to 40% for non-caged nests. However, these data do not indicate how much of a factor predation, the reason for caging nests, play in nest success.

Table 19. Piping Plover Caged vs. Non-Caged Nests by Segment							
Segment	Caged Nests	Successful Caged Nests	% Successful Nests Caged	Non-Caged Nests*	Successful Non-Caged Nests*	% Successful Non-Caged Nests	% Nests Caged
Fort Peck Lake	0	0	0	2	0	0	0
Lake Sakakawea	0	0	0	139	58	42	0
Garrison River	85	67	79	19	8	42	82
Lake Oahe	97	61	63	78	31	40	55
Fort Randall River	9	5	56	6	3	50	60
Lewis and Clark Lake	29	13	45	16	9	56	64
Gavins Point River	138	107	78	43	11	26	76
Total	358	253	71	303	120	40	54

*Not included in the non-caged nests and successful non-caged nests are the 68 piping plover broods that were never found as nests

The causes for nest losses for caged versus non-caged nests are shown in Table 20. Predation was the cause of loss for 2% (6/358) of the caged nests and for 4% (12/303) of the losses for non-caged nests. The highest percent of nest losses for caged nests were due to weather events (7%), nest abandonment (5%), and not enough evidence to determine the cause of the nest loss (5%). For non-caged nests the highest losses were due to flooding (22%) and not enough evidence to determine the cause of the nest loss (18%). For both caged and non-caged nests, a high percentage of nests fell into the category where the nest fate was not determined – 8% for caged nests and 7% for non-caged nests.

Table 20. Caged vs. Non-Caged Nest Percent Losses by Cause, 2008		
Cause	% Caged Nests	% Non-Caged Nests
Flooding	2	22
Weather	7	7
Predation	2	4
Bank Erosion	0	0
Human Disturbance	1	1
No Evidence	5	18
Abandoned	5	2
Undetermined	8	7

RPM 8 – Monitor and Evaluate Effectiveness of Created and Rehabilitated Sandbars

RPM – 8.1. Created Sandbars

The Corps constructed sandbar complexes on the Gavins Point River Segment at RM 755.0 in 2004, at RM 770.0 and RM 761.3 in 2005, and at RM 791.5, RM 777.7, and RM 775.0 in the fall of 2007/spring of 2008. In the fall of 2006/spring of 2007 and the fall of 2007/spring of 2008, the Corps constructed a sandbar complex in the Lewis and Clark Lake Segment at RM 826.5. Piping plovers used all seven

constructed sandbar complexes in 2008. Tables 21 and 22 present the nest success on constructed sandbars versus non-constructed sandbars in the Lewis and Clark Lake and Gavins Point River Segments. The first table shows that the majority of the plover nests for the Lewis and Clark Lake segment were found on the constructed sandbar complex. However, the nest success on the constructed sites was 46%, which is considerably lower than the nest success for the non-constructed sites (63%). The second table shows nearly two-thirds of the plover nests on the Gavins Point River Segment were on the constructed sandbar complexes in 2008. The nest success was very good at 63% but was below the nest success of 73% found on the non-constructed sites (73%).

Table 21. Piping Plover Nest Success on Constructed vs. Non-Constructed Sandbars – Lewis and Clark Lake Segment, 2008

Habitat Type	Total # of Nests	Successful	Not Successful	Not Determined	% Successful	% of Total Nests
Constructed	37	17	19	1	46	82
Non-Constructed	8	5	3	0	63	18
Total	45	22	22	1	49	100

Table 22. Piping Plover Nest Success on Constructed vs. Non-Constructed Sandbars – Gavins Point River Segment, 2008

Habitat Type	Total # of Nests	Successful	Not Successful	Not Determined	% Successful	% of Total Nests
Constructed	120	75	40	5	63	64
Non-Constructed	67	49	16	1	73	36
Total	187	124	46	6	66	100

Tables 22 and 23 present the data on adults, fledglings, and fledge ratio for the piping plovers at the Lewis and Clark Lake and Gavins Point River Segments, respectively. The first table shows that, on Lewis and Clark Lake, the majority of the adults and all of the fledglings were on the constructed sandbars. The constructed sandbars had a very high fledge ratio of 1.63 fledglings per adult pair, which was well above the BiOp metric of 1.22 fledglings per adult pair. On the Gavins Point River Segment, Table 24, a little bit more than half of the plover adults were on the constructed sandbar complexes, but over two-thirds of the fledglings were on the constructed sites. The fledge ratio of 1.68 for the constructed sites was well above the BiOp metric of 1.22, while the fledge ratio was 1.01 for the non-constructed sites.

Table 23. Piping Plover Adults, Fledglings, and Fledge Ratios on Constructed vs. Non-Constructed Sandbars – Lewis and Clark Lake Segment, 2008

Habitat Type	Adults	% of Total Adults	Fledglings	% of Total Fledglings	Fledge Ratio
Constructed	48	84	39	100	1.63
Non-Constructed	9	16	0	0	0
Total	57	100	39	100	1.37

Table 24. Piping Plover Adults, Fledglings, and Fledge Ratios on Constructed vs. Non-Constructed Sandbars – Gavins Point River Segment, 2008					
Habitat Type	Adults	% of Total Adults	Fledglings	% of Total Fledglings	Fledge Ratio
Constructed	180	56	151	68	1.68
Non-Constructed	140	44	71	32	1.01
Total	320	100	222	100	1.39

RPM 8.2 − Rehabilitated Sandbars

The Corps has conducted vegetation modification on existing sandbars on the Lake Oahe, Fort Randall River, Lewis and Clark Lake, and Gavins Point River Segments. Vegetation modification includes the herbicide spraying of vegetation or herbicide spraying followed by the mowing of the vegetation. Vegetation modification results are listed below by segment.

RPM 8.2.a − Lake Oahe Segment

Due to continued drought in the upper Missouri River Basin, Lake Oahe has been lowered to the point that a large part of the upper lake has returned to a riverine environment. In the fall of 2006, three sandbars and one sandbar complex were sprayed with herbicide to eliminate vegetation. Subsequently in the spring of 2007, the sandbars were mowed to cut down the dead vegetation. The sandbars that received treatment were at RM 1293.0 (Rifle Range), RM 1286.2 (Silo), RM 1285.0 (Fire Island), and RM 1284.0 (Barrels). At the sandbar complexes located at RM 1286.2 (Silo) and RM 1284.0 (Barrels), piping plovers nested on parts of the sandbars that did not receive the herbicide spraying or the herbicide spraying and mowing treatment. This habitat type is listed in the Table 24 as spray and mow (nat). The riverine part of Lake Oahe in 2008 extended from RM 1304 down to RM 1263.5. Those sites not listed above are identified as not treated in the table. This included 27 sites in 2008. Table 25 compares the nest success between the treated and non-treated sandbars on this riverine part of Lake Oahe. It shows that the treated sites accounted for a little less than 20% of the piping plover nests in 2008. The treated sites, however, had a higher nest success compared to the portions of the islands not treated and the not treated sites.

Table 25. Piping Plover Nest Success by Treatment Type – Upper Reach of the Lake Oahe Segment, 2008						
Treatment Type	Total Nests	Successful Nests	Not Successful	Not Determined	% Successful	% of Total Nests
Spray and Mow	16	12	3	1	75	19
Spray and Mow (Nat)	2	1	1	0	50	2
Not Treated	67	43	16	8	64	79
Total	85	56	20	9	66	100

According to the data presented in Table 26, the treated sites accounted for a little more than 20% of the adults and 25% of the fledglings. The fledge ratio of 1.29 for the treated sites was above the BiOp fledge ratio metric of 1.22, while that for non-treated sites (1.11) was slightly below the BiOp metric. It needs to be noted that piping plovers had a much higher use of and were more successful in fledging chicks on the treated sites in upper Lake Oahe than were the least terns. The reason for this is not known.

Table 26. Piping Plover Productivity by Treatment Type – Upper Reach of the Lake Oahe Segment, 2008					
Treatment Type	Adults	% of Total Adults	Fledglings	% of Total Fledglings	Fledge Ratio
Spray and Mow	31	23	20	25	1.29
Spray and Mow (Nat)	2	2	3	4	3
Not Treated	103	76	57	71	1.11
Total	136	100	80	100	1.18

RPM 8.2.b. Fort Randall River Segment

On this segment, two types of vegetation modification treatments have been used, herbicide spraying only and herbicide spraying followed by mowing. The sandbars that have undergone vegetation modification are listed below by treatment type and year of treatment.

Sprayed Only: Sandbars at RM 866.9 and 866.5 were sprayed with herbicide in the fall of 2005 but the dead plant material was not removed.
Spray 2005, Mow 2006: RM 870.2, RM 863.7 (part), RM 854.5, RM 854.0, RM 851.7 (part), RM 848.5, and RM 846.5
Spray 2005, Mow 2007: RM 869.5 (part)

At the sandbars located at RM 870.2 and 866.5, piping plovers nested on parts of the sandbars that did not receive the herbicide spraying or the herbicide spraying and mowing treatments. These habitat types are listed in the Table 27 as spray only (nat) and spray and mow (nat). There are sandbars that currently, or since 1998, have had least tern and/or piping plover nesting and where no management activity such as spraying or spraying and mowing has occurred. These sandbars include sites at RM 875.0, RM 869.5 (part), RM 855.5, and RM 853.4. This habitat type is listed as not treated in the table, which shows that a little more than half of the piping plover nests were on the treated sites in 2008. While these piping plovers were on the spray and mow sites, their nest success was less than 50 percent.

Table 27. Piping Plover Nest Success by Treatment Type – Fort Randall River Segment, 2008						
Treatment Type	Total Nests	Successful Nests	Not Successful	Not Determined	% Successful	% of Total Nests
Spray Only	0	0	0	0	0	0
Spray and Mow	9	4	4	1	44	56
Spray Only (Nat)	5	4	1	0	80	31
Spray and Mow (Nat)	1	0	1	0	0	6
Not Treated	1	1	0	0	0	6
Total	16	9	6	1	56	100

Table 28 shows the productivity on the various treatment types. It shows that a little less than half of the plover adults and little less than a quarter of the fledglings were on the treated sites. This resulted in a fledge ratio of 0.50, which was far below the BiOp metric of 1.22. The non-treated sites and the natural areas of the treated sites combined for slightly over three quarters of the fledglings and a fledge ratio of 1.43.

Table 28. Piping Plover Productivity by Treatment Type – Fort Randall River Segment, 2008					
Treatment Type	Adults	% of Total Adults	Fledglings	% of Total Fledglings	Fledge Ratio
Spray Only	0	0	0	0	0
Spray and Mow	12	46	3	23	0.50
Spray Only (Nat)	8	31	8	62	2.00
Spray and Mow (Nat)	2	8	0	0	0
Not Treated	4	15	2	15	1.00
Total	26	100	13	100	1.00

RPM 8.2.c. Lewis and Clark Lake Segment

On this segment there have been two types of vegetation modification treatments, herbicide spraying only and herbicide spraying followed by mowing. The sandbars that have undergone vegetation modification are listed below by treatment type and year of treatment.

Sprayed: The sandbar at RM 839.5 was sprayed with herbicide in the fall of 2005, but the dead plant material was not removed.
Spray 2004, Mow 2006 – RM 838.2
Spray 2005, Mow 2006 – RM 839.0
Spray 2005, Mow 2007 – RM 842.2, RM 838.0, and RM 837.0

There are sandbars that currently, or since 1998, have had least tern and/or piping plover nesting and where no management activity such as spraying or spraying and mowing has occurred. These sandbars include sites at RM 843.3, RM 842.8, RM 842.6, RM 841.9, RM 840.0, RM 839.7, RM 838.6, RM 836.0, RM 835.0, RM 834.3, RM 832.2, RM 830.3, RM 828.4, and RM 827.0. This habitat type is listed as not treated in the Table 29. The table, which shows the nest success for the various habitat and treatment types, also refers to the constructed sandbar complex at RM 826.5 as constructed. The table shows that piping plovers did not nest on the treated sites in 2008.

Table 29. Piping Plover Nest Success by Treatment Type – Lewis and Clark Lake Segment, 2008						
Treatment Type	Total	Successful	Not Successful	Not Determined	% Successful	% of Total
Spray Only	0	0	0	0	0	0
Spray and Mow	0	0	0	0	0	0
Not Treated	8	5	3	0	0	18
Constructed	37	17	19	1	46	82
Total	45	22	22	1	44	100

Table 30 shows the productivity for the treatment types. There was no productivity on the sites that were previously treated or not treated. The only piping plover productivity on the Lewis and Clark Lake Segment was at the constructed site, where the fledge ratio was 1.63, well above the BiOp metric of 1.22.

Table 30. Piping Plover Productivity by Treatment Type – Lewis and Clark Lake Segment, 2008					
Treatment Type	Adults	% of Total Adults	Fledglings	% of Total Fledglings	Fledge Ratio
Spray	0	0	0	0	0
Spray and Mow	0	0	0	0	0
Not Treated	9	16	0	0	0
Constructed	48	84	39	100	1.63
Total	57	100	39	100	1.37

RPM 8.2.d. Gavins Point River Segment

On this segment, there have been two types of vegetation modification treatments, herbicide spraying only and herbicide spraying followed by mowing. The sandbars that have undergone vegetation modification are listed below by treatment type and year of treatment.

Sprayed: Sandbars at RM 796.3, RM 768.0 and RM 759.5 were sprayed with herbicide in the fall of 2005, but the dead plant material was not removed.
Spray 2004, Mow 2005: RM 781.5
Spray 2004, Mow 2005 and 2006: RM 756.7
Spray 2004 and 2005, Mow 2007: RM 777.7
Spray 2005, Mow 2006: RM 801.1, RM 759.2, and RM 757.2
Spray 2005, Mow 2007: RM 799.0, RM 796.3, RM 795.3, RM 793.6, RM 793.3, RM 790.9, RM 789.6, RM 786.1, RM 785.2, RM 784.5, RM 783.0, RM 782.5, RM 778.5, and RM 773.0

At the sandbar located at RM 782.5, piping plovers nested on a part of the sandbar that did not receive the herbicide spraying and mowing treatment. This is listed in the Table 31 as spray and mow (nat). There are sandbars that currently have, or since 1998 have had, least tern and/or piping plover nesting, where no management activity such as spraying or spraying and mowing has occurred. These sandbars include sites at RM 808.2, RM 807.6 (shoreline), RM 807.4, RM 807.3, RM 807.2, RM 804.6, RM 804.5, RM 803.4, RM 802.5, RM 801.3, RM 797.7, RM 795.4, RM 795.3, RM 791.5, RM 788.5, RM 786.0, RM 779.2, RM 779.1, RM 779.0, RM 778.9, RM 777.8, RM 777.5, RM 777.0, RM 776.5, RM 776.4, RM 775.2, RM 764.5 RM 759.0, RM 758.9, and RM 760.0. This habitat type is listed as not treated in Table 30. The constructed sandbars were at the following locations: RM 791.5, RM 777.7, RM 775.0, RM 770.2, RM 770.1, RM 770.0, RM 769.9, RM 761.3, RM 755.0, and RM 754.2. The table, which provides data on the nest success for the various habitat and treatment types, shows there was little nesting by the piping plovers on the treated sites with only 5% of the nests occurring on those sites in 2008.

Table 31. Piping Plover Nest Success by Treatment Type – Gavins Point River Segment, 2008						
Treatment Type	Total	Successful	Not Successful	Not Determined	% Successful	% of Total Nests
Spray Only	0	0	0	0	0	0
Spray and Mow	10	7	3	0	70	5
Spray and Mow (Nat)	6	3	2	1	50	3
Not Treated	51	39	12	0	77	27
Constructed	120	75	40	5	63	64
Total	187	124	57	6	66	100

Table 32 shows the productivity for the treatment types. It shows that 8% of the adults and 3% of the fledglings occurred on the treated sites in 2008. This produced a combined fledge ratio of 0.44, which is less than the BiOp metric of 1.22 and far below the 1.46 fledge ratio for all other sites on the Gavins Point River Segment.

Table 32. Piping Plover Productivity by Treatment Type – Gavins Point River Segment, 2008

Treatment Type	Adults	% of Total Adults	Fledglings	% of Total Fledglings	Fledge Ratio
Spray Only	0	0	0	0	0
Spray and Mow	26	8	7	3	0.54
Spray and Mow (Nat)	10	3	1	1	0.20
Not Treated	104	33	63	28	1.21
Constructed	180	56	151	68	1.68
Total	320	100	222	100	1.39

IV.C.5. Kansas River Piping Plovers

IV.C.5.a. Incidental Take

There were no piping plover adults, chicks, or eggs that were lost on the Kansas River in 2008 due to Corps' operations.

IV.C.5.b. Reasonable and Prudent Measures

RPM 1 – Survey and Monitor Piping Plovers, Mortality, and Incidental Take

RPM 1.1 – Summary Data

In 2008, an adult census and productivity monitoring were conducted for piping plovers on the Kansas River. The adult census for piping plovers was zero. No plover nests were found on the Kansas River in 2008.

IV.D. Bald Eagle Summary

The bald eagle was reclassified as threatened in 1995 and was removed from the Federal threatened and endangered species list on August 8, 2007. However, the bald eagle is still protected by the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act, and the Corps will continue to follow the recommendations of the BiOp.

The Corps continued to oversee the contract to conduct and write a Programmatic Environmental Assessment and Cottonwood Management Plan (Cottonwood Management Plan). In 2008, the draft version of Chapter 3 of the Cottonwood Management Plan, which discusses potential implementation and restoration and/or preservation strategies (measures), was completed. The Corps' contractor also obtained and incorporated review comments on the measures from members of the core cottonwood team and assisted with organizing the Habitat Evaluation Procedures (HEP) Analysis for Cottonwood Riparian Community Workshop, held February 19-22, 2008, in Vermillion, South Dakota. The workshop was conducted by the Corps, its Engineer Research and Development Center (ERDC), the University of South Dakota (USD), the South Dakota State University (SDSU), and the contractor. The purpose of the workshop was to review elements of the cottonwood model and adjust the model, as needed, based on input from the core technical team. Work on the model continued through November, culminating in a workshop that was held November 18-21, 2008. Only minor changes will be made to the model after the November

workshop. A meeting summary of the February workshop can be found at: https://www.nwo.usace.army.mil/html/pd-e/workshop.html.

In October 2008, the Corps' contractor and ERDC staff met in the field with USD and NPS staff to determine potential restoration or preservation alternatives for cottonwood forest sites along segment 10 of the river, which lies between Gavins Point Dam and Ponca, Nebraska.

In the spring of 2008, the Corps entered into an arrangement with the USGS to construct Land-Capability Potential Index (LCPI) maps for the Missouri River valley bottom along Gavins Point Dam to Ponca segment. The LCPI maps will provide valuable information on the use of Missouri River valley bottom lands that can be used in the cottonwood model and Cottonwood Management Plan.

The Corps continued to oversee another contract to organize, conduct, analyze, and summarize vegetation sampling along seven segments [segments 2 (Fort Peck Dam to Lake Sakakawea Headwaters near Williston, North Dakota), 4 (Garrison Dam to Lake Oahe Headwaters near Bismarck, North Dakota), 6 (Oahe Dam to Big Bend Dam), 8 (Fort Randall Dam to Niobrara River), 9 (Niobrara River to Lewis and Clark Lake, and Lewis and Clark Lake), 10 (Gavins Point Dam to Ponca, Nebraska), and 13 (Platte River to Kansas City, Missouri)] of the Missouri River. Segment 2 serves as a reference condition segment since it has not been altered dramatically. The contractor includes researchers, professors, and graduate students from SDSU, USD, Benedictine College, and USGS.

During the summer of 2008, the USD team sampled over-story and under-story vegetation on 29 forest stands within segment 8 (13 cottonwood, 8 non-cottonwood, 2 disturbed cottonwood), 19 stands within segment 10 (13 non-cottonwood, 6 disturbed cottonwood), and 21 stands within segment 6 (15 cottonwood, 4 non-cottonwood, 2 disturbed cottonwood). The USGS sampled 25 cottonwood stands along the Wild and Scenic reach in Montana upstream from Fort Peck Lake, 30 cottonwood stands on segment 2 (below Fort Peck), 55 stands on segment 4 (41 cottonwood, 10 non-cottonwood, 4 disturbed cottonwood), and 12 stands at the upstream end of segment 5 (adjacent to segment 4). These 67 stands in segment 4/5 (below Garrison) included 27 stands that had originally been sampled by Carter Johnson and Warren Keammerer in 1969/1970, enabling assessment of the effects of 39 years of change. The Benedictine team sampled 37 stands (19 cottonwood, 12 non-cottonwood, 6 disturbed cottonwood) on segment 13. All three teams compiled species lists and voucher specimens for their segments. The USD team completed GIS coverages depicting land cover for 1892, the mid-1950s, and 2006 and produced maps of riparian forest age classes for segments 2, 4, 6, 8, 9, 10, and 13, based on overlays of historic photographs or maps from 1892, mid-1950s, 1980s, 1997 (for segments 8-10), and 2006. In addition, the USGS team completed GIS coverage of land cover and riparian forest age classes for the Wild and Scenic reach above Fort Peck Lake. All three teams contributed to ground-truthing the maps within their respective study reaches. Initial analyses have also been conducted of land cover transitions on segment 10 for 1892-1956, 1956-1984, and 1984-2006. A draft report on the results of the initial analysis has been completed.

The Corps delivered a presentation on the cottonwood model entitled "Landscape and Vegetative Forecasting for the Missouri River" at the MRNRC Conference and BiOp Forum, which was held February 26-28, 2008 in Nebraska City, Nebraska. The Corps also delivered a presentation entitled "Community Index-based Modeling efforts for the Cottonwood Riparian Forest along the Missouri River" at the Corps' Planning Community of Practice Conference, which was held May 19-22, 2008 in San Antonio, Texas.

The Finding of No Significant Impact (FONSI) for the monitoring plan and environmental assessment for the Little Bend River Restoration Project, a cottonwood forest restoration project on the Lower Brule Sioux Tribe Reservation in South Dakota, was completed in 2008. This project will include the planting of over 4,800 cottonwood seedlings and over 10,000 seedlings or plugs of native riparian tree, shrub, and vine species. This project will be considered for the FY 2009 budget.

On February 17, 2008, the Corps participated in a panel discussion on the future of cottonwood trees along the Missouri River. Other panel participants included professors from USD who are members of the cottonwood team. The program was held in Sioux City, Iowa and was attended by the public.

In June 2008, the Corps met in the field with representatives from the Missouri River Futures and Nebraska Forest Service to learn about the Forest Legacy Program, a conservation easement program that could be applied to cottonwood forest preservation sites.

V. Public Involvement and Coordination

V.A. Missouri River Recovery Implementation Committee

The MRRIC Planning Group, made up of representatives of basin Tribes, states, and stakeholders, finalized and forwarded a recommended Charter for the MRRIC to the ASA(CW) on February 5, 2008.

Upon receipt of the recommended Charter, the Corps and USFWS, working in concert, offered government-to-government consultation with the 28 Tribes in the Missouri River Basin. All 28 Tribes were contacted, and face-to-face meetings were held with 14 of them. Comments from the Tribes included requests to add a citation for the Winters' Doctrine, a 1908 Supreme Court ruling that recognized the doctrine of reserved water rights, which assures that Native American lands will receive sufficient water to fulfill the purposes of their reservations, and to add a definition for the term "in good faith".

HQUSACE and the office of the ASA(CW) also extensively reviewed the recommended Charter and requested that changes be made to ensure the Charter would meet legal and policy requirements. These proposed changes, along with those requested by the Tribes, were forwarded to the Planning Group for review.

The Planning Group met on June 30, 2008 in St. Louis, Missouri to review the changes to the Charter proposed by the Tribes, the office of the ASA(CW), and HQUSACE. Following detailed discussions on the proposed changes, the Charter was finalized through consensus of the Planning Group. On July 1, 2008, the ASA(CW), the Honorable John Paul Woodley, signed Implementation Guidance for Section 5018 of the Water Resources Act of 2007 (WRDA 2007). By signing the Guidance, Mr. Woodley approved the MRRIC Charter and established the Committee.

Subsection (b) of Section 5018 of WRDA 2007 required the establishment of the MRRIC to provide guidance to the Secretary (of Army) on the study to be conducted under subsection (a) and to provide recommendations and guidance to the Secretary with respect to the Missouri River recovery and mitigation activities already underway.

Approval of the MRRIC Charter marked the culmination of over a year of work by the MRRIC Planning Group. Federal agencies in the basin also participated in the process by forming a FWG to assist the Planning Group. The effort benefited from the guidance and facilitation assistance provided by the U.S. Institute for Environmental Conflict Resolution (U.S. Institute) and its contractor, Ruth Siguenza and Associates.

The Implementation Guidance for Section 5018 of WRDA 2007 by ASA(CW) delegated the authority to implement the Charter, select and appoint members, and administer and support the MRRIC to the Commander, NWD.

The inaugural meeting of the MRRIC was held September 29 through October 1, 2008 in St. Louis. The MRRIC is made up of representatives of basin Tribes, states, and stakeholders as well as Federal agencies with responsibilities that affect the river. While the Tribes, states, and Federal agencies appointed their representatives, the stakeholder representatives were selected through an application process. Twenty-eight stakeholder representatives were selected for 16 basin interest categories. Those applying for a stakeholder position were required to submit an application and letters of recommendation to demonstrate their qualifications.

The first meeting of the MRRIC was attended by over 50 members from all of the aforementioned categories. Attendees included representatives from all eight basin States and five basin Tribes. All 28

stakeholder representatives and 10 Federal agencies representatives attended. With reimbursement of travel expenses of members by Federal funding prohibited by Section 5018 of WRDA 2007, attendance at the two-and-a-half-day meeting by so many individuals is an indication of the degree of interest in Missouri River recovery issues in the basin.

The initial meeting focused primarily on developing operating procedures for the MRRIC. An interim committee chairman was selected by consensus vote of the members. Mr. Randy Asbury, an At-Large representative from Higbee, Missouri, will act as interim chairman until a chairman is selected to serve. The committee formed sub-groups to pursue recommendations on nominees for chairman, grants for travel expense reimbursement, technological applications to aid communication, drafting of proposed operating procedures, and preparation of the agenda for the next meeting.

Information-sharing is and will be a significant component of the MRRIC's agenda. The committee heard information on the MRRP, the MRERP, and pallid sturgeon recovery efforts at its first meeting. A guest speaker, Mr. Jimmy Bullock, shared his experiences in multi-stakeholder collaboration in black bear conservation with the MRRIC. A list of information topics was developed by the Federal agencies and provided to the group for possible presentation ideas for subsequent meetings.

In addition to information-sharing, Section 5018 of WRDA 2007 tasks the MRRIC with providing input to and recommendations on recovery activities in the basin and the study that will result in the MRERP. Committee members have indicated that they are prepared to influence decision-making and are interested in the specific activities, processes, and time-frames for their input.

The initial meeting was facilitated by the U.S. Institute, which will continue to provide facilitation support until the MRRIC is able to contract with a facilitation team, using the U.S. Institute roster of qualified facilitators.

The MRRIC held its second meeting in Omaha, Nebraska on December 16-18, 2008. All of the MRRIC meetings are open to the public.

V.B. Information and Data Advisory Team

V.B.1. Introduction

The mission of the IDA Team is to provide support and guidance to the MRRP for the effective collection, storage, and distribution of data, knowledge, and information to enable efficient communication and execution of program resources. The IDA Team is comprised of personnel from the Northwestern Division, Engineer Research and Development Center, Omaha District, and Kansas City District and contract personnel.

Efforts completed in 2008 include:

- Deployed the official MRRP website;
- Implemented a collaboration software solution;
- Deployed Project Work Request (PWR) tool; and
- eGIS Products

V.B.2. The Official MRRP Web Site

During 2007, the need was identified to consolidate several MRRP web sites. A centralized public communication conduit was lacking. The Kansas City District had a web site, the Omaha District had some information on its web site, and the MRRIC had a separate web site. The MRRP needed one place the public could go for information. Thus, a draft public web site for the MRRP was created. A web domain name was purchased, and the site was built using the adopted infrastructure and framework.

During 2008, the website was launched using the purchased domain name. The content for the web site is continually updated, and there are plans to empower the various teams with the tools to update and approve their own content. The MRRP web site is averaging 4000 data hits per day.

A couple of additional domain names were purchased for MRERP and MRRIC. These domains will take the Internet browser directly to that tab within the MRRP web site with the corresponding Uniform Resource Locator (URL): MRRP Home Page - http://www.moriverrecovery.org, MRERP - http://www.mrerp.org, and MRRIC - http://www.mrric.org.

V.B.3. Team Collaboration Software

Team collaboration software is used to facilitate teams in working together collectively while located remotely from each other. The software enables real-time collaboration, which can include the sharing of calendars, collective writing, e-mail handling, shared database access, and electronic meetings. The Corps' standard collaboration tool, Groove, was not designed for teams as large as the MRRP team. An alternative was needed. During 2007, WebEx was selected to fill a short-term role as the collaboration software for the MRRP. There were two team collaboration sites setup and currently using WebEx.: MRRP - http://www.moriverrecovery.webexone.com and MRERP - http://www.moriver.webexone.com

V.B.4. PWR Manager

During the 2007 Annual Team Meeting, it was apparent that some assistance was needed to facilitate the development of the annual budgets. The current procedure had the team members identify potential work requests and their capability and the SPDT perform its own grouping, rewriting and prioritizing of those work requests to develop the budget. The administration of this process was extensive. The team members and the service providers did not receive any direct feedback on the results. The process needed more tracking and a tool to facilitate the administration of the PWRs.

The PWR Manager was the result. It allows the team members to input their work requests and provides a tool for the team members to group and prioritize their requests for the SPDT. The SPDT can then rank all the requests based upon three different budget levels. Improvement of the PWR Manager is continuing. The URL for the PWR Manager is http://www.moriverrecovery.org/mrrp/f?p=108

V.B.5. Enterprise Geographic Information Systems (eGIS)

The eGIS team is responsible for geospatial data consolidation and database management for the MRRP. Combined efforts between the Omaha and Kansas City Districts involve the consolidation of geospatial data into one centralized geodatabase and provide GIS users with access to the most current data. The eGIS team has also made aerial photography available through an Image Server application within GIS software. The Image Server application provides Computer-Aided Design and Drafting (CADD) and GIS users with the highest quality Missouri River imagery and uses compression techniques that expedite viewing capability. This server is accessible to anyone in the Omaha or Kansas City Districts who uses GIS software.

Additionally, the eGIS team developed a series of templates that provide continuity for mapping prepared for the MRRP. Templates are available in numerous page and scale sizes and can be applied to existing or new mapping products. Using these templates, base mapping at a basin wide and a recreational mapping scale have been developed and illustrate basic features along the Missouri River.

Mitigation land-cover mapping has been developed for over 50 active mitigation sites. Land-cover series exist and are currently being developed to display early European settlement conditions, time-of-purchase land cover conditions, current baseline, and desired conditions.

In an effort to provide one location for all mapping products, datasets, online applications, and mapping resources, the eGIS team developed the eGIS Clearinghouse. The Clearinghouse is housed through WebEx and is a data repository that provides direct access to mapping products, GIS database files, and eGIS mapping resources. All mapping products produced for the MRRP are made available through the eGIS Clearinghouse located within WebEx: https://moriverrecovery.webexone.com .

Future efforts for the eGIS team in FY09 include:

- Additional base mapping series produced at 1:12,000 scale and 1:24,000 scale
- Additional Mitigation Project mapping to include 14 new baseline maps, 5 time-of-purchase maps, 9 updates to baseline maps, and the collection of historic land cover
- Development of an online mapping application housed on a public website to provide wide access to MRRP geodatabase

V.C. Communications Plan

In 2008, the MRRP Communication Team initiated communication activities in support of the MRRP and its components. Communication activities this year focused on communication planning, development of collateral materials, and team-member training and preparation for interaction with stakeholders and the public.

V.C.1. Communication Planning

A comprehensive External Communication Plan was developed to guide communication activities. The plan included several elements: an analysis of the current communication situation, including an audit of recent Corps media coverage and the results of 35 stakeholder interviews; communication objectives; strategic approach; audiences; communication tactics; methods of measurement and evaluation; and a timeline of activities. The plan also included the initial versions of the MRRP message plan and an information distribution database of stakeholders and locations along the river. Both the message plan and the database were greatly expanded and refined throughout the year. A separate media plan and contact database was developed to specifically address outreach to local and regional media representatives.

To maintain agreement and consistency in the direction and focus of communications efforts, the Communication Team kept in daily contact via e-mail and phone calls. The Team convened every 2 to 4 weeks via conference calls for more formal communication planning. Throughout the year, the Team evaluated and modified its efforts based on feedback from stakeholders and ongoing media monitoring.

V.C.2. Collateral Materials

The Communication Team focused in this initial phase on producing information pieces that could easily describe an overview of the MRRP to a general audience. These materials included an eight-page brochure, full-color folder, short video, and placemat. To provide additional information on several of the MRRP components, the Team produced 10 two-page fact sheets on the following topics: bald eagles and cottonwoods, Emergent Sandbar Habitat Program, least terns and piping plovers, monitoring, Missouri River Ecosystem Restoration Plan, Missouri River Recovery Implementation Committee, pallid sturgeon, sediment management, Shallow Water Habitat Program, and spring rise.

The Team produced three quarterly newsletters (winter, spring, and summer 2008) to provide updates on the MRRP. Content of the fall 2008 newsletter is being developed as of November 2008. Newsletters were distributed to a mailing list of over 360 external stakeholders with Missouri River interests. Bulk copies (10-20) were mailed to nearly 100 locations along the river with a letter signed by Program Manager, Mike George, requesting that the locations display the newsletters for their patrons' information. For more frequent updates, nine monthly e-mail bulletins (March through November 2008) were developed. Over 300 contacts, both within and outside the Corps, receive a notification when these bulletins are published.

The Team began planning for more in-depth outreach for the MRRP's components, starting with the ESH and SWH Programs. Outreach plans were developed for both programs and a large poster was produced for the ESH Program that is to be displayed at conferences and other presentations. The Team went further in planning for SWH Program outreach, identifying communities near SWH projects for outreach efforts and developing initial outreach materials and contact databases.

A few items were developed specifically for distribution to MRRP team members, including a Certificate of Appreciation and a poster showing the locations of all MRRP offices. The following technical summaries were developed to provide background information to team members: Biological Opinion and Shallow Water Habitat, Clean Water Act Permits, Jameson Island Chute Project, Missouri River Sediment, Mitigation and Recovery Summary, Operations and Maintenance, Regulatory Considerations, Sediment Deposition and Water Quality, and Sediment Quick Facts.

V.C.3. Team Training

The Communications Team offered several training sessions and developed tools for interacting with stakeholders and the public.

The Media and Message Track Training sessions introduced useful approaches to planning and delivering messages to a variety of audiences. The first half of the training was an interactive-message development session, during which the MRRP team refined its core messages and enhanced the existing message plan. During the second half of the training, participants worked in groups to plan responses to mock scenarios. The teams made decisions about communication strategies, key messages, target audiences, and tactics. The training prepared MRRP team members with interview and presentation techniques and key messages.

The International Association for Public Participation's Decision Makers Course examined the foundations of public participation from a decision-maker's point of view and offered perspectives on how public participation can be integrated into an overall program plan. MRRP team members learned how public participation ties into their decision-making processes; when and why to have the public participate in their decisions; what the decision-maker's unique role and commitment are to stakeholders; and what key concepts must be considered to be effective when involving others.

Consequence Communication and Conflict Management Training provided strategies and tips for acting as a great program representative even when "the going gets tough." Consequence Communication covered the ethics and risks of this kind of communication, perceptions of impacts, outrage factors, and factors influencing trust and credibility. Conflict Management covered basic conflict management concepts, attitudes and behaviors, and common public concerns.

The Team organized and hosted five events to roll out the communication program to MRRP staff. These events were held in Kansas City, Pierre, Yankton, Omaha, and Bismarck (USFWS staff participated in the Bismarck event as well). During these events, tool boxes for and tool kits of materials and MRRP-branded items were presented to each office and member of the MRRP team, along with a contact list of MRRP team members. In addition, the Media and/or Message Track Training sessions described above were offered at each of these events.

In addition to training sessions, the Team developed a number of tools that MRRP spokespersons can use when interacting with stakeholders and the public. These tools include an MRRP PowerPoint presentation and presentation template; Speakers Bureau script, presentation, manual, and database of possible contacts; and MRRP web address card and electronic template.

In summary, the efforts by the MRRP Communications Team over the past year have established a solid foundation of communication strategies, messages, and materials to sustain a long-term communication effort for Missouri River recovery and restoration.

VI. Literature Cited

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